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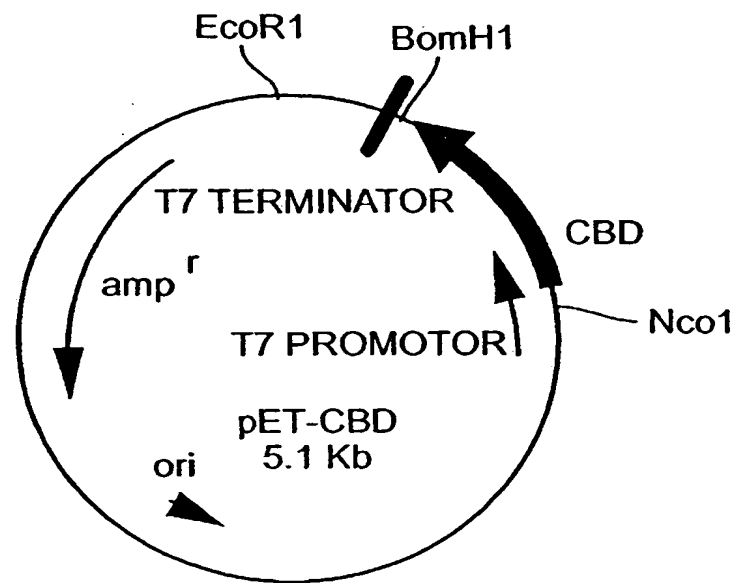


Fig. 1a

10	20	30	40	50	
GCA GCG ACA TCA TCA ATG TCA GTT GAA TTT TAC AAC TCT AAC AAA TCA GCA CAA					
CGT CGC TGT AGT AGT TAC AGT CAA CTT AAA ATG TTG AGA TTG TTT AGT CGT GTT					
Ala Ala Thr Ser Ser Met Ser Val Glu Phe Tyr Asn Ser Asn Lys Ser Ala Gln>					
10					
60	70	80	90	100	
ACA AAC TCA ATT ACA CCA ATA ATC AAA ATT ACT AAC ACA TCT GAG AGT GAT TTA					
TGT TTG AGT TAA TGT GGT TAT TAG TTT TAA TGA TTG TGT AGA CTG TCA CTA AAT					
Thr Asn Ser Ile Thr Pro Ile Ile Lys Ile Thr Asn Thr Ser Asp Ser Asp Leu>					
20 30					
110	120	130	140	150	160
AAT TTA AAT GAC GTA AAA GTT AGA TAT TAT TAC ACA AGT GAT GGT ACA CAA GGA					
TTA AAT TTA CTG CAT TTT CAA TCT ATA ATA ATG TGT TCA CTA CCA TGT GTT CCT					
Asn Leu Asn Asp Val Lys Val Arg Tyr Tyr Tyr Thr Ser Asp Gly Thr Gln Gly>					
40 50					
170	180	190	200	210	
CAA ACT TTC TGG TGT GAC CAT GCT GGT GCA TTA TTA GGA AAT AGC TAT GTT GAT					
GTT TGA AAG ACC ACA CTG GTA CGACCA CGT AAT AAT CCT TTA TCG ATA CAA CTA					
Gln Thr Phe Trp Cys Asp His Ala Gly Ala Leu Leu Gly Asn Ser Tyr Val Asp>					
60 70					
220	230	240	250	260	270
AAC ACT AGC AAA GTG ACAGCA AACTTC GTT AAA GAA ACA GCA AGC CCA ACA TCA					
TTG TGA TCG TTT CAC TGT CGT TTG AAG CAA TTT CTT TGT CGT TCG GGT TGT AGT					
Asn Thr Ser Lys Val Thr Ala Asn Phe Val Lys Glu Thr Ala Ser Pro Thr Ser>					
80 90					

Fig. 1b

280	290	300	310	320	
ACC TAT GAT ACA TAT GTT GAA TTT GGATTT GCA AGC GGA GCA GCT ACT CTT AAA					
TGG ATA CTA TGT ATA CAACTT AAA CCT AAA CGT TCG CCT CGT CGA TGA GAA TTT					
Thr Tyr Asp Thr Tyr Val Glu Phe Gly Phe Ala Ser Gly Ala Ala Thr Leu Lys>					
100					
330	340	350	360	370	
AAA GGA CAA TTT ATA ACT ATT CAA GGAAGA ATA ACA AAA TCA GAC TGG TCA AAC					
TTT CCT GTT AAA TAT TGATAA GTT CCT TCT TAT TGT TTT AGT CTG ACC AGT TTG					
Lys Gly Gln Phe Ile Thr Ile Gln Gly Arg Ile Thr Lys Ser Asp Trp Ser Asn>					
110 120					
380	390	400	410	420	430
TAC ACT CAA ACA AAT GAC TAT TCA TTT GAT GCA AGT AGT TCA ACA CCA GTT GTA					
ATG TGA GTT CTG TTA CTG ATA AGT AAA CTA CGT TCA TCA AGT TGT GGT CAA CAT					
Tyr Thr Gln Thr Asn Asp Tyr Ser Phe Asp Ala Ser Ser Ser Thr Pro Val Val>					
130 140					
440	450	460	470	480	
AAT CCA AAA GTT ACA GGA TAT ATA GGT GGA GCT AAA GTA CTT GGT ACA GCA CCA					
TTA GGT TTT CAA TGT CCT ATA TAT CCA CCT CGA TTT CAT GAA CCA TGT CGT GGT					
Asn Pro Lys Val Thr Gly Tyr Ile Gly Gly Ala Lys Val Leu Gly Thr Ala Pro>					
150 160					

Fig. 1c

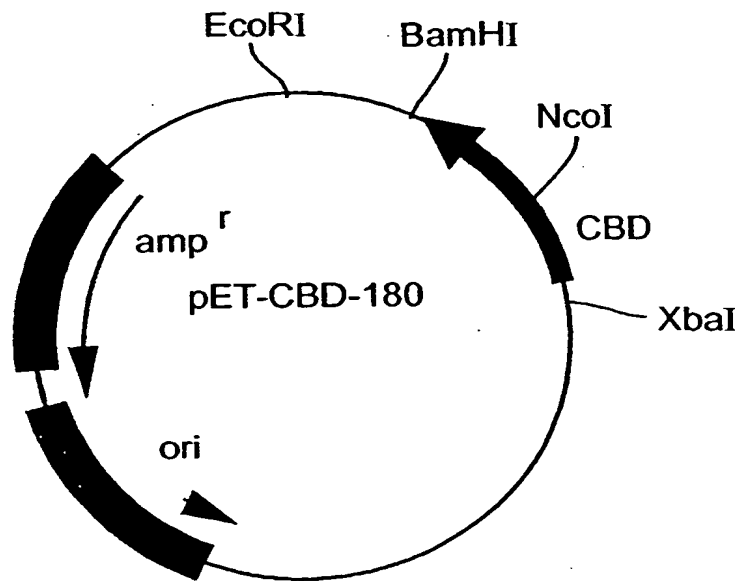


Fig. 1d

CBD - 180 CONTAINS 180 AMINO ACIDS OF CBD_{clos}

With 182 enzymes: *

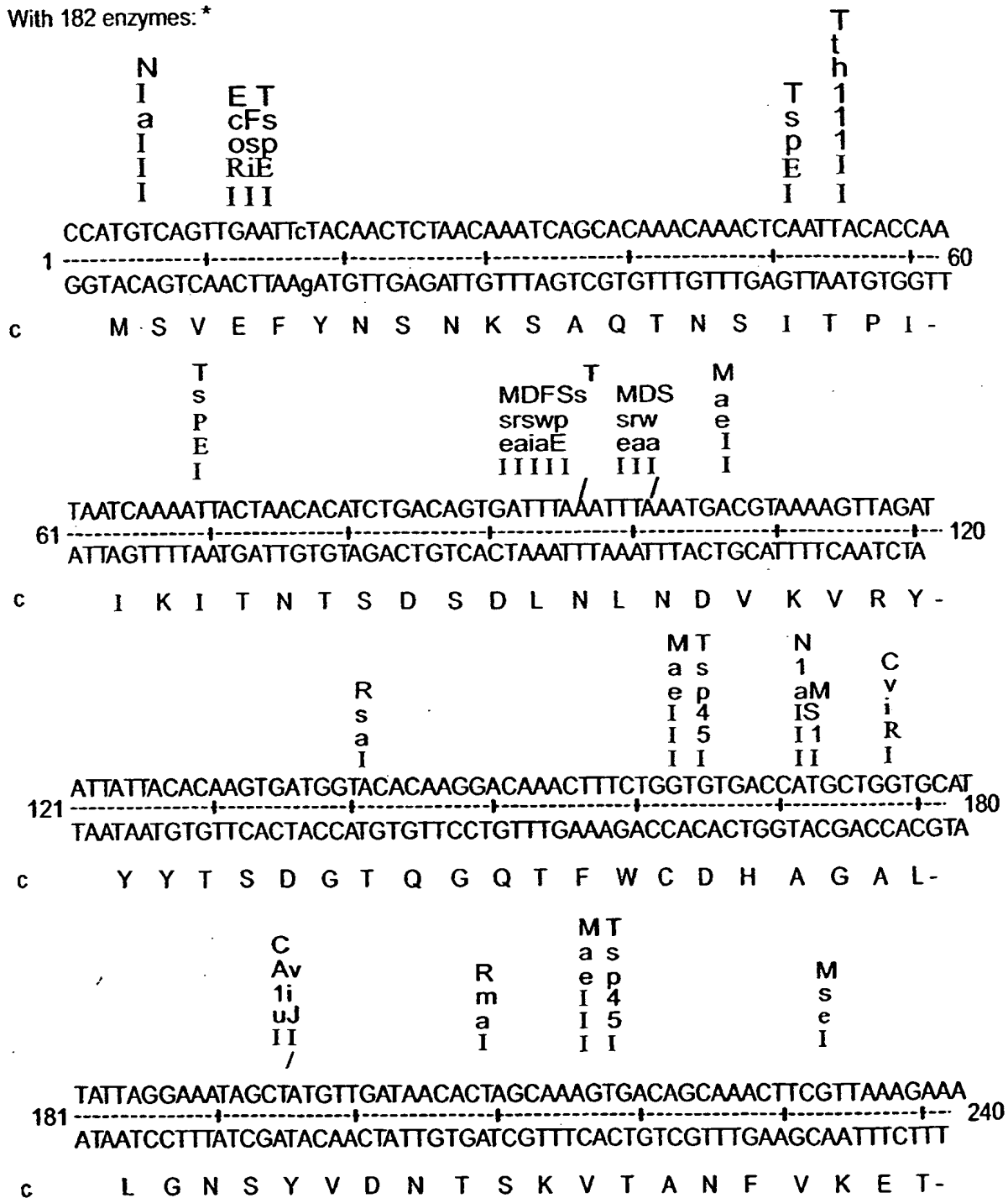


Fig. 1e

C A S P T S T Y D T Y V E F G F A S G R A-

C v i J I /	m s e I	T s p E I	M b o I I	B s r I
----------------------------	------------------	-----------------------	-----------------------	------------------

c T L K K G Q F I T I Q G R I T K S D W S-

s f a N I
 T h 1 1 1 I
 c v i R I
 B s r I

C N Y T Q T N D Y S F D A S S S T P V V N-

M				E	S
a	c			c	S
e	Av	RS	R	o	Aa
I	li	sc	s	r	vu
I	uJ	aa	a	I	a9
I	I	I	I	I	I
	/	/			/

C P K V T G Y I G G A K V L G T A P G P D-

M			T	C	S	N	B	1C	C
b	R	B	sAM	v	a	D	MNBc1RsDKNavNaR		
o	s	c	pss	i	u	p	scarasaspclihcm		
I	a	c	Eee	R	A	n	pinFlaJanoIJe8a		
I	I	I	III	I	I	I	IIIIIVIIIIIIIIII		
1f			/				// // // / /		

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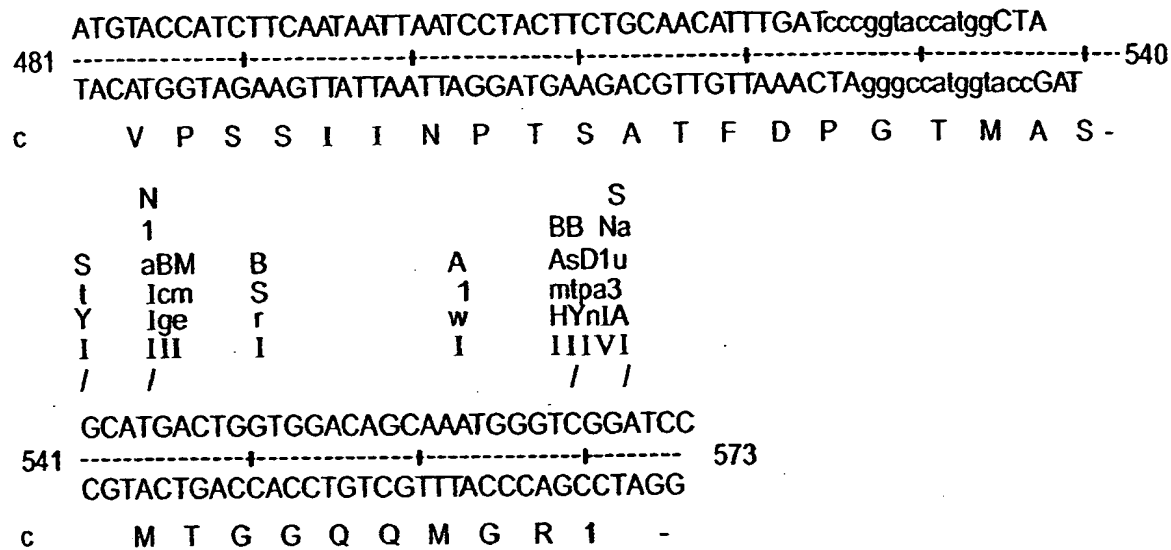


Fig. 1g

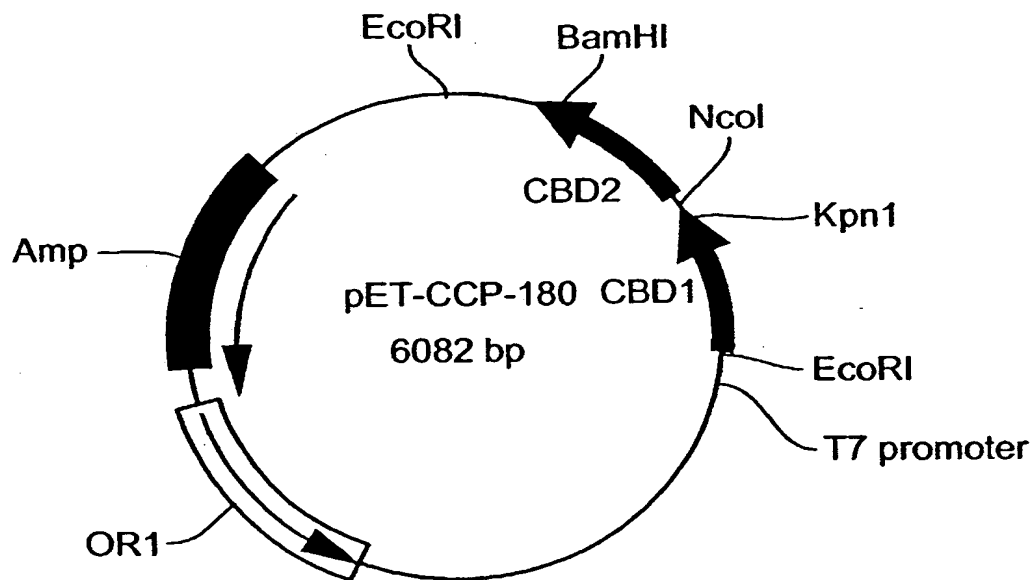


Fig. 2a Map of pET-CCP

MAP OF CCP

CCP = CBD CROSS LINKER PROTEIN, CONTAIN TWO CBDs
FUSED TOGETHER.

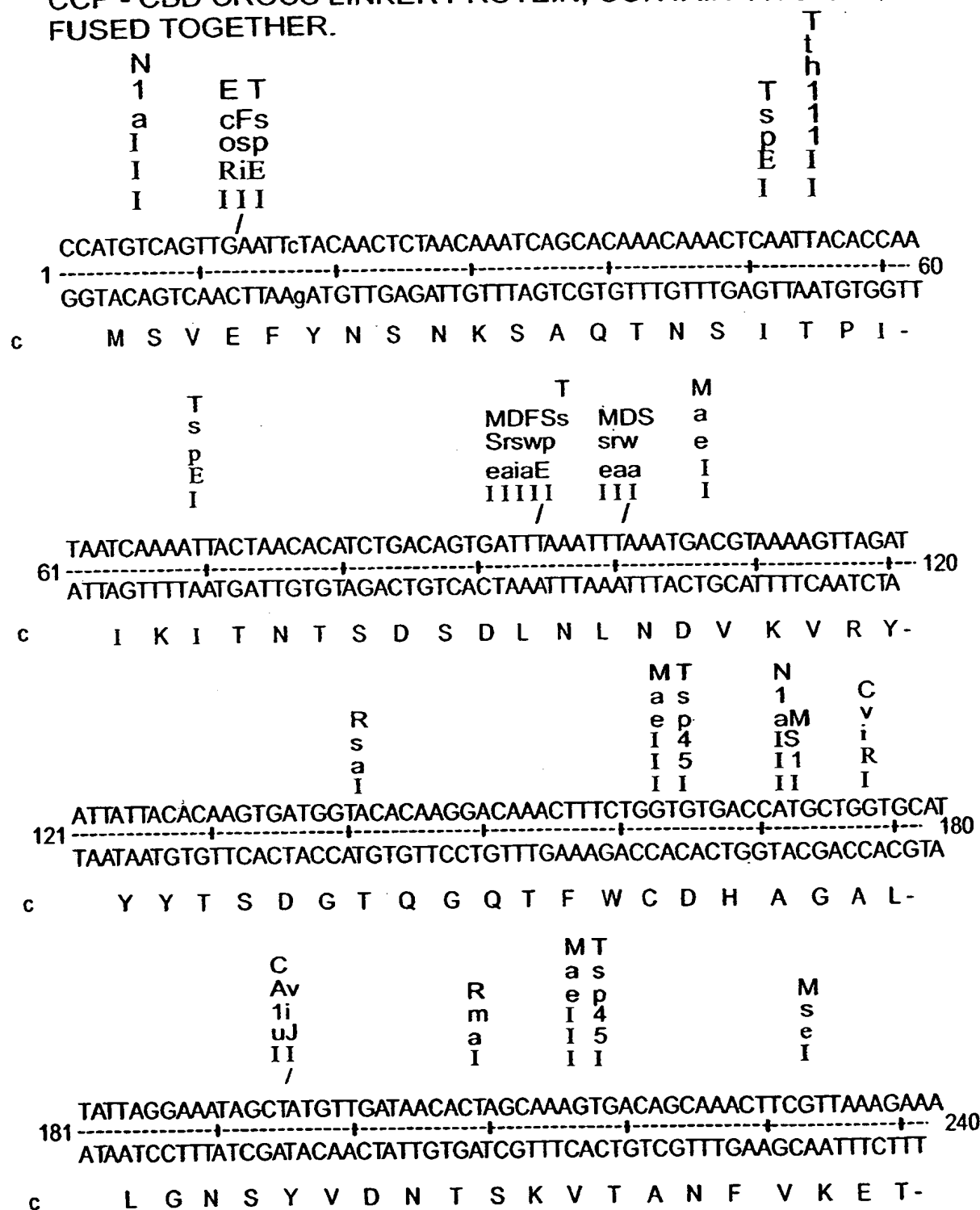


Fig. 2b

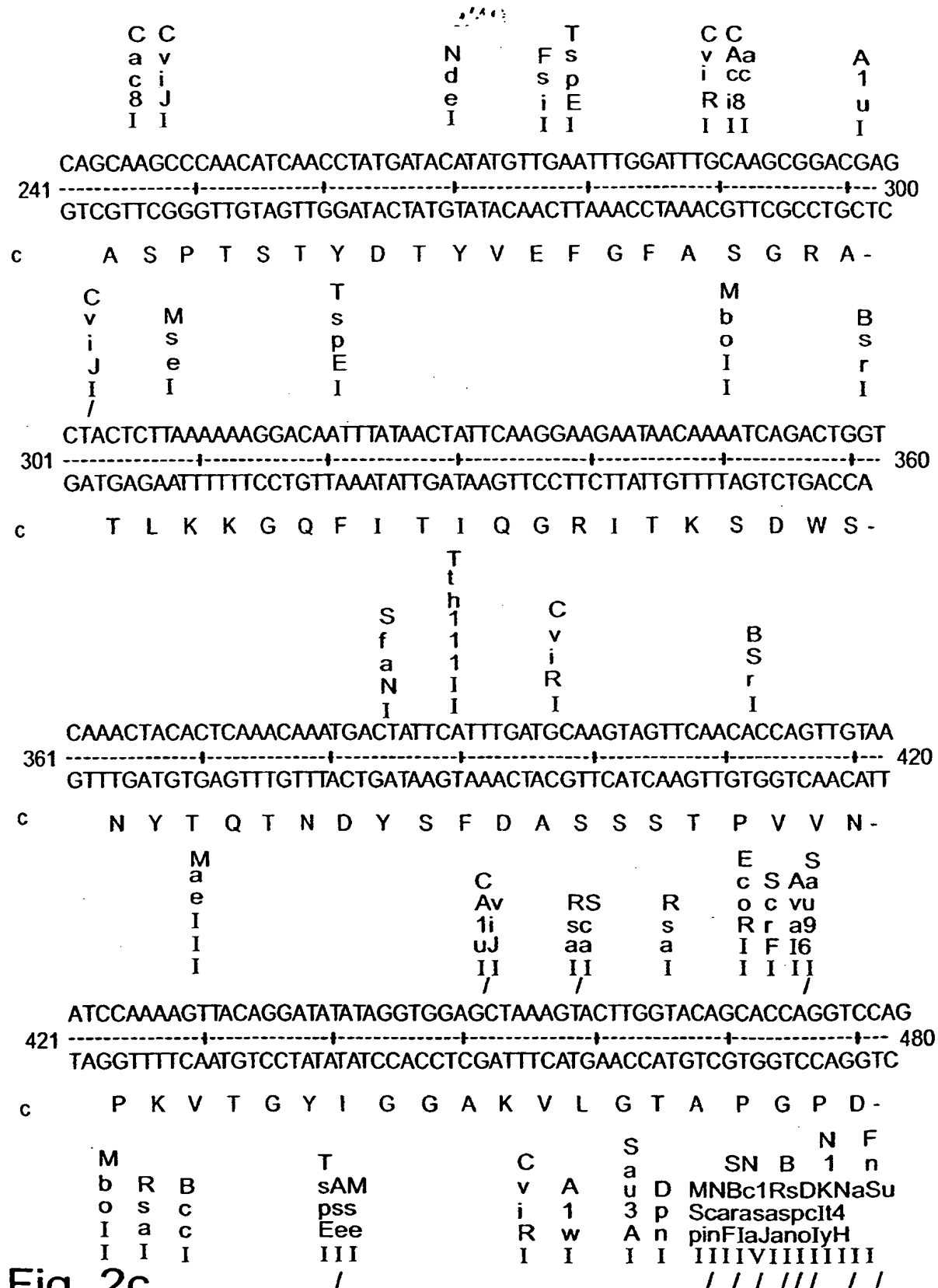
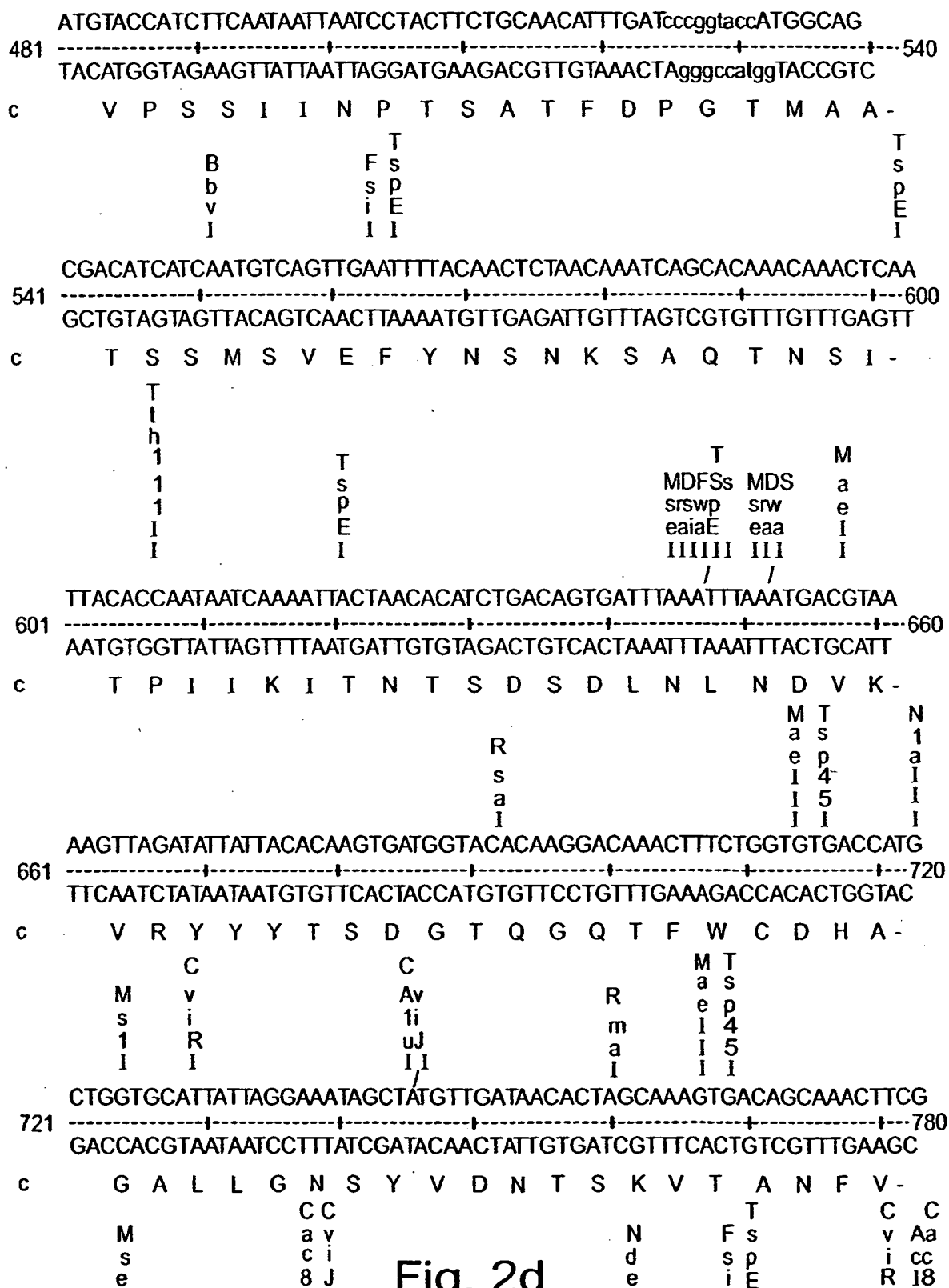


Fig. 2c



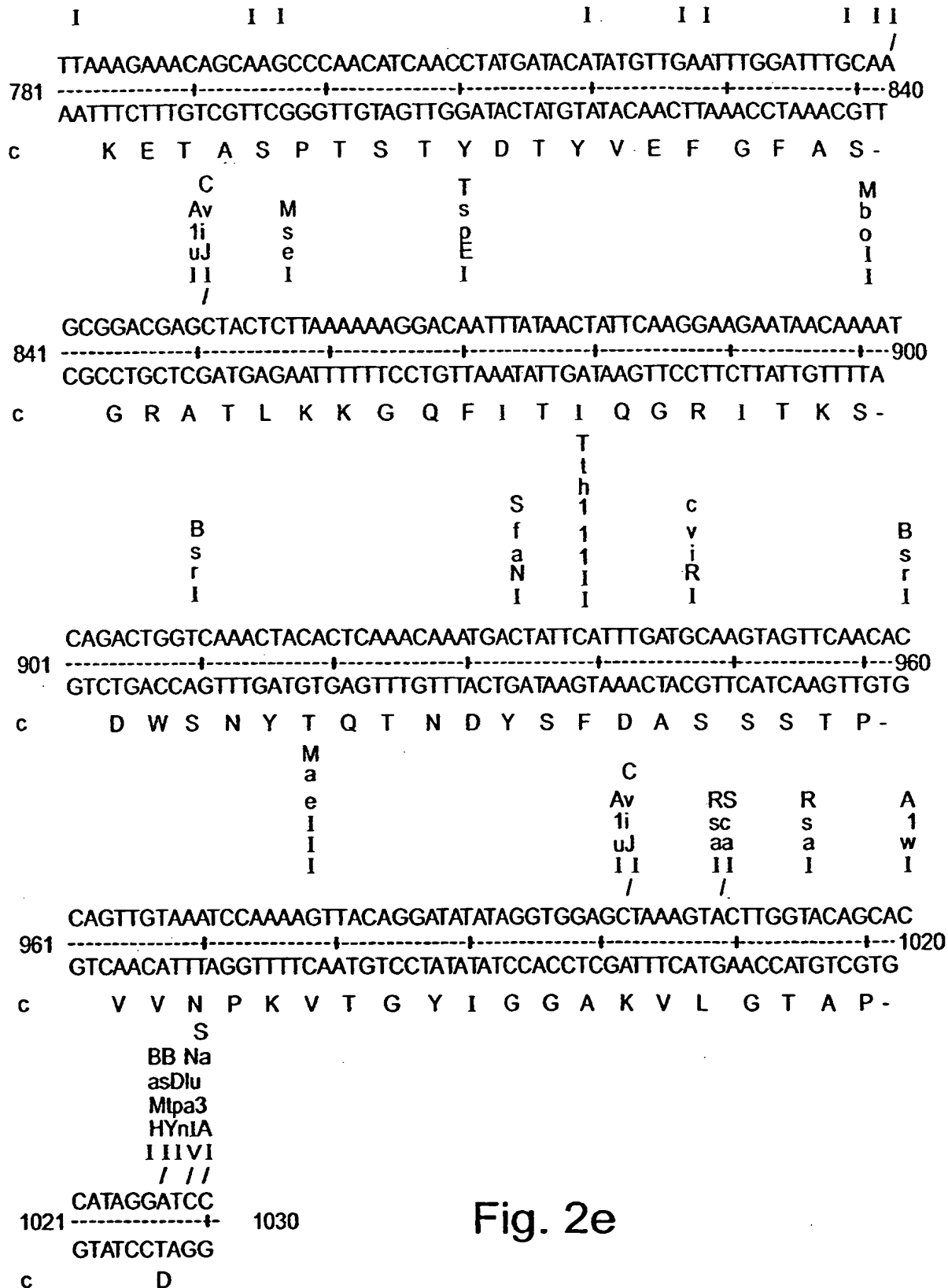


Fig. 2e

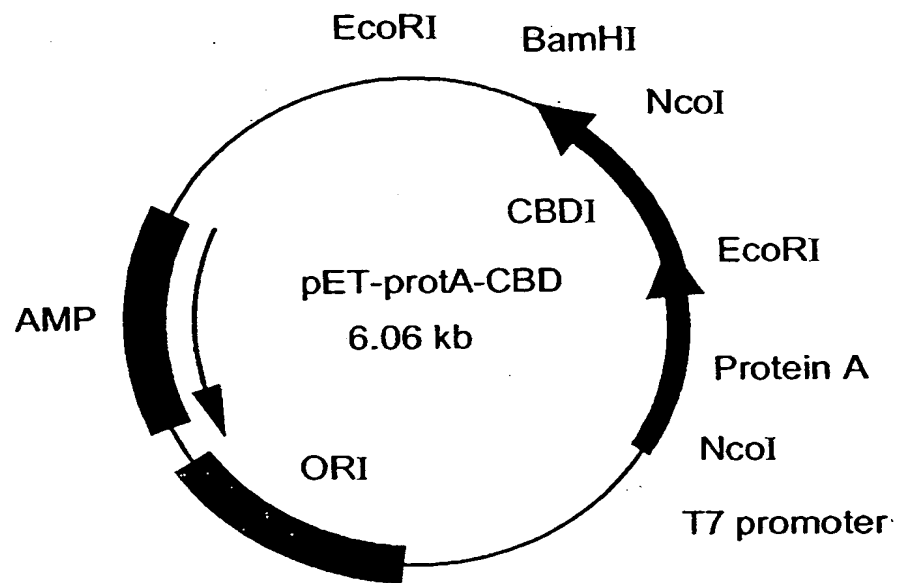


Fig. 3a Map of pET-protA-CBD

Map of protA-CBD

July 15, 1996 17:31

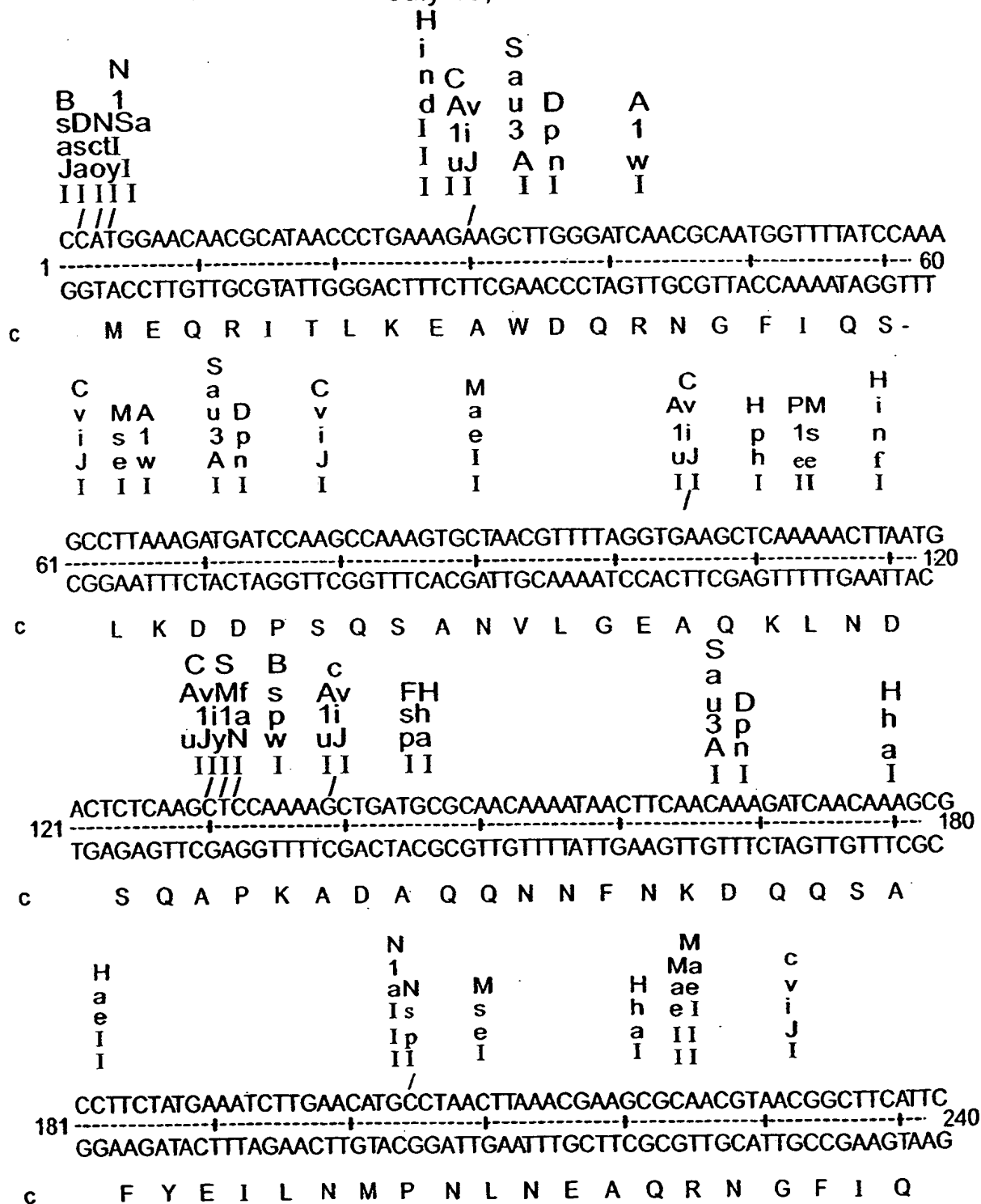


Fig. 3b

Fig. 3c

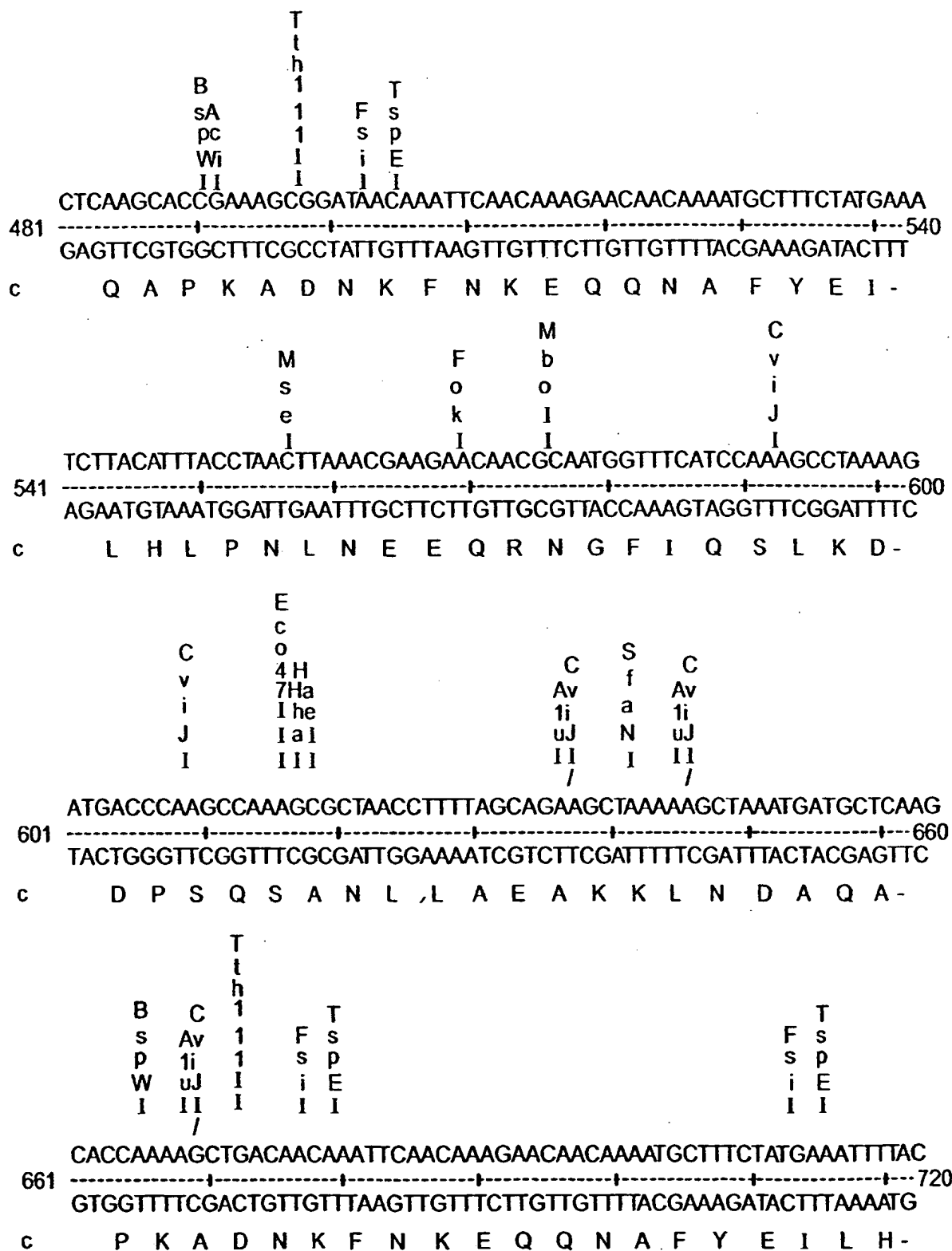


Fig. 3d

Fig. 3e

Fig. 3e

M M C E CB S B
F ae b v o vc M A u D s
o e l o i 5 ie s 1 3 p a
k I I I J 7 Jf e w A n J
I I I I I I I I I I I I

ATTTACCTAACTTAAGGAACAACGTAACGGCTTCATCCAAAGCCTTAAAGACGATC
721 -----+----- 780
TAAATGGATTGAATTGACTTCTTGTTGCATTGCCGAAGTAGGTTTCGGAATTTCTGCTAG

c L P N L T E E Q R N G F I Q S L K D D P -
NF
S E T B 1 n T
MNC cFs sDNSa u B F s
scr osp ascII 4 b s p
piF RiE Jaoyl H v i E
III III IIIII I I I
/// / ///

CGGGGAATTCATGGCAGCGACATCATCAATGTCAGTTGAATTTACAACTCTAACAAT
781 -----+----- 840
CCCCCTTAAGGTACCGTCGCTGTAGTAGTTACAGTCAACTTAAAATGTTGAGATTGTTTA

c G N S M A A T S S M S V E F Y N S N K S -
T
t
h
1
T s 1 1 T s M
p 1 1 p s
E I I E e
I I I I I

CAGCACAAACAACTCAATTACACCAATAATCAAATTAACACATCTGACAGTGATT
841 -----+----- 900
GTCGTGTTTGTTGAGTTAATGTGGTTATTAGTTTTAATGATTGTGTAGACTGTCACTAA

c A Q T N S I T P I I K I T N T S D S D L -
T M
DFSs MDS a R
rsw srw e s
aiaE eaa I a
III I III I I

TAAATTTAAATGACGTAAAAGTTAGATATTATTACACAAGTGATGGTACACAAGGACAAA
901 -----+----- 960
ATTTAAATTTACTGCATTTTCAATCTATAATAATGTGTTCACTACCATGTGTTCTGTTT

c N L N D V K V R Y Y Y T S D G T Q G Q T -
MT N
a s 1 C C R
ep aM v Av m
I 4 Is i li a
I 5 I I R uJ I
I I II I II /

CTTTCTGGTGTGACCATGCTGGTGCATTATTAGGAAATAGCTATGTTGATAACACTAGCA
961 -----+----- 1020
GAAAGACCACACTGGTACGACCACGTAATAATCCTTTATCGATACAACATTGTGATCGT

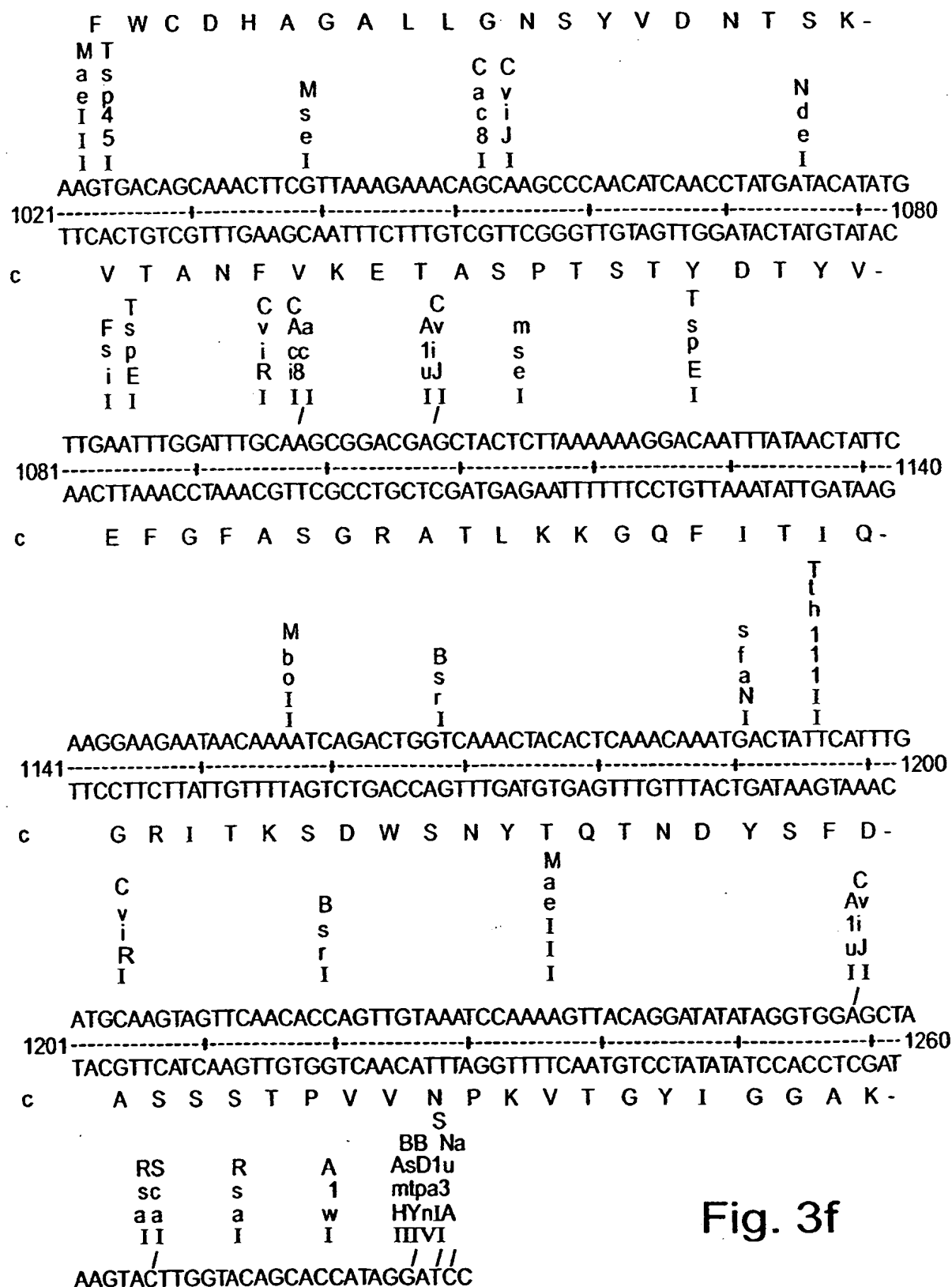


Fig. 3f

1261-----1288
 TTCATGAACCATGTCGTGGTATCCTAGG
 c V L G T A P * D -

Fig. 3g

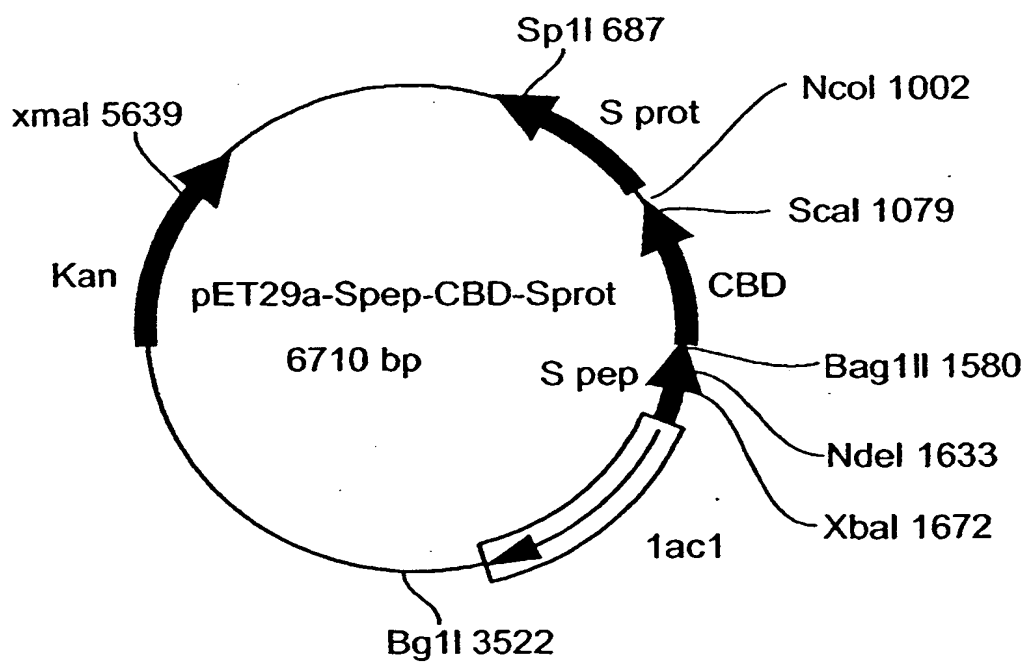
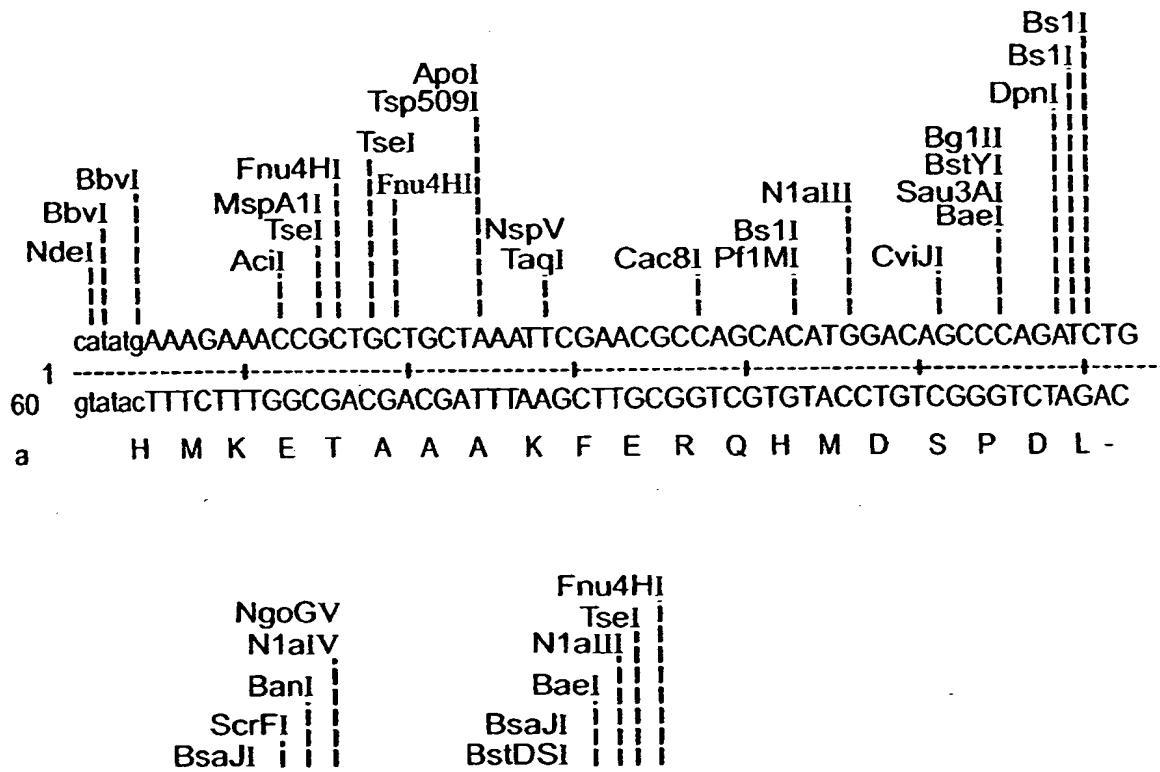


Fig. 4a Map of pET29-Spep-CBD-Sprot

Fig. 4b

Map of: S peptide-CBD-S protein

November 10, 1999 14:34



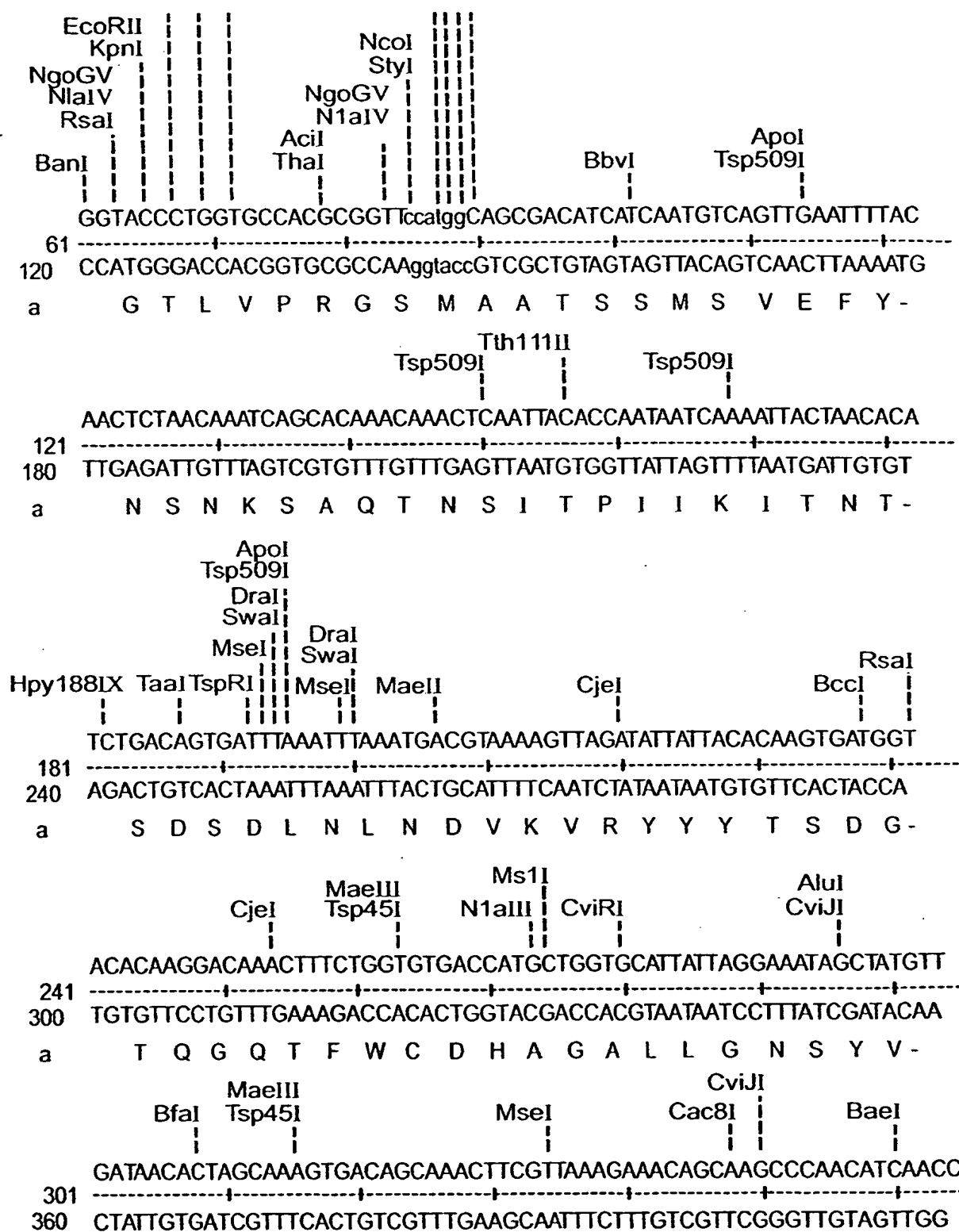
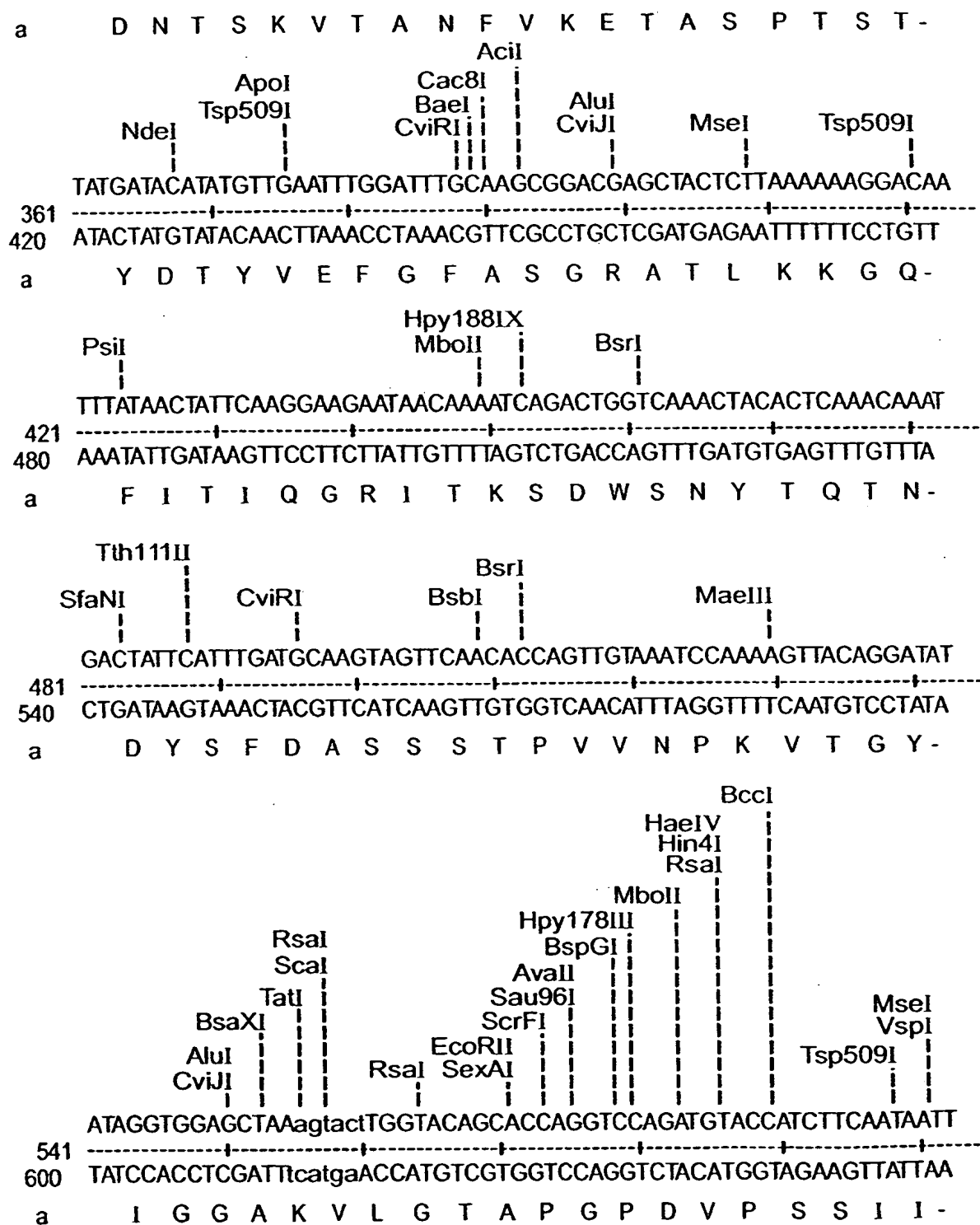


Fig. 4c



NgoGV
N1aIV

Fig. 4d

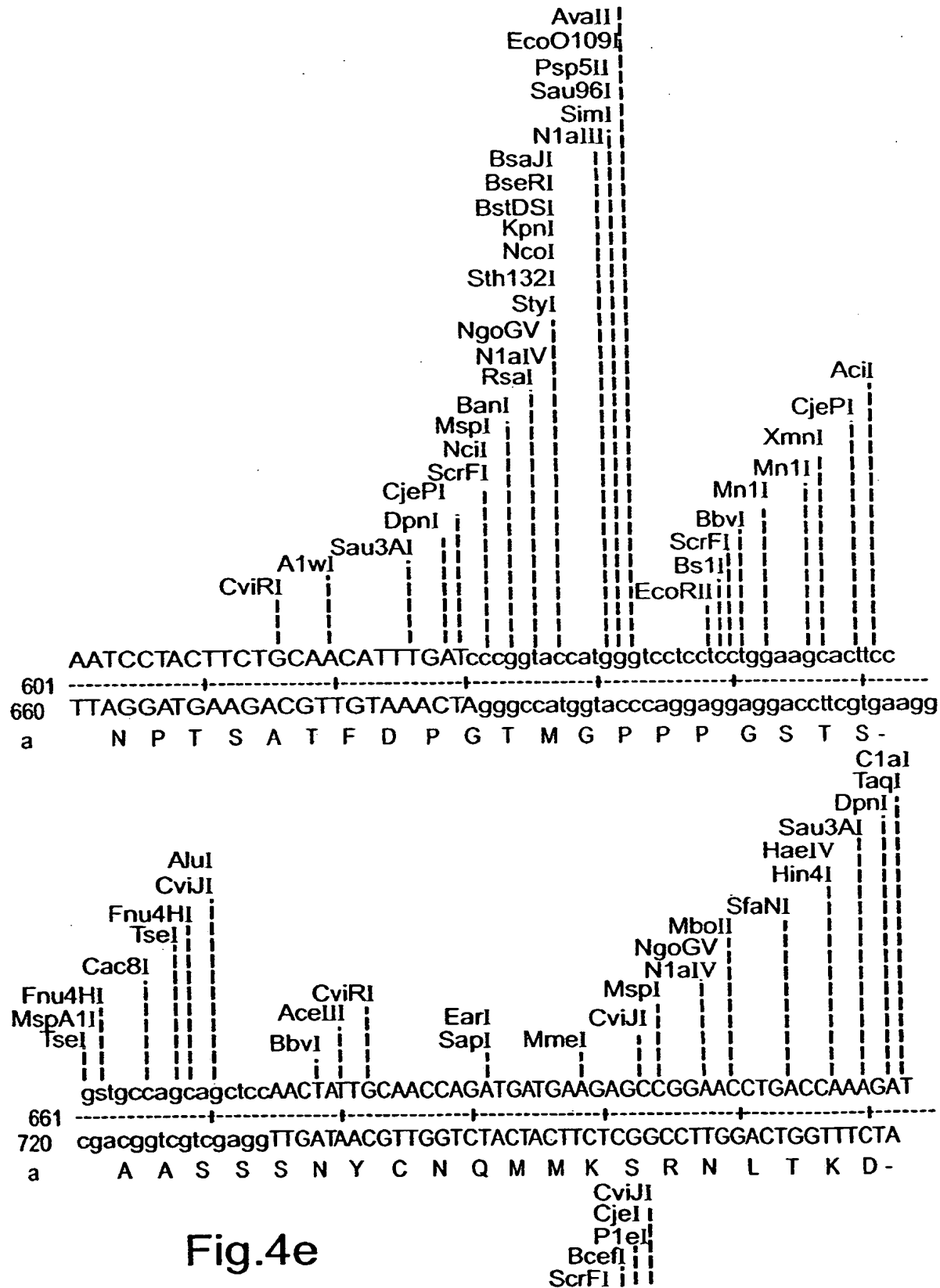


Fig.4e

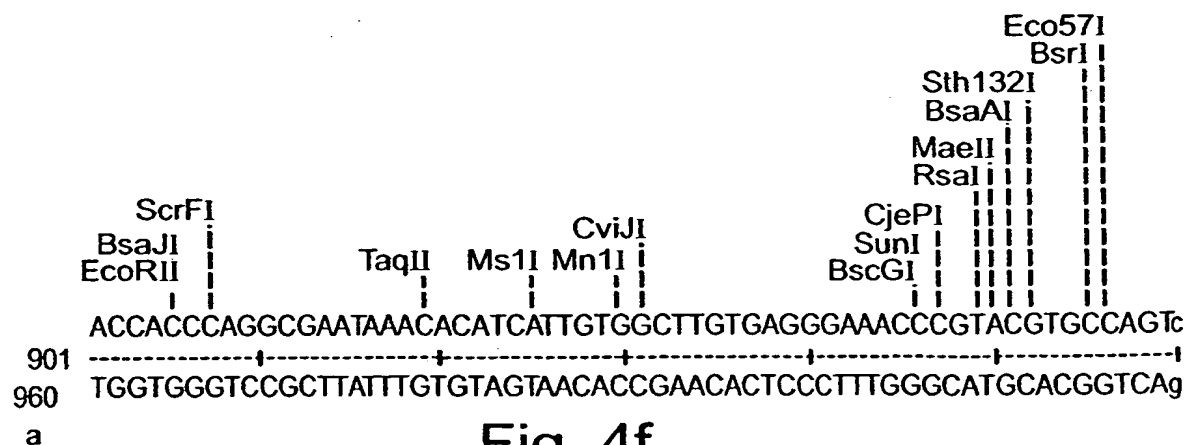
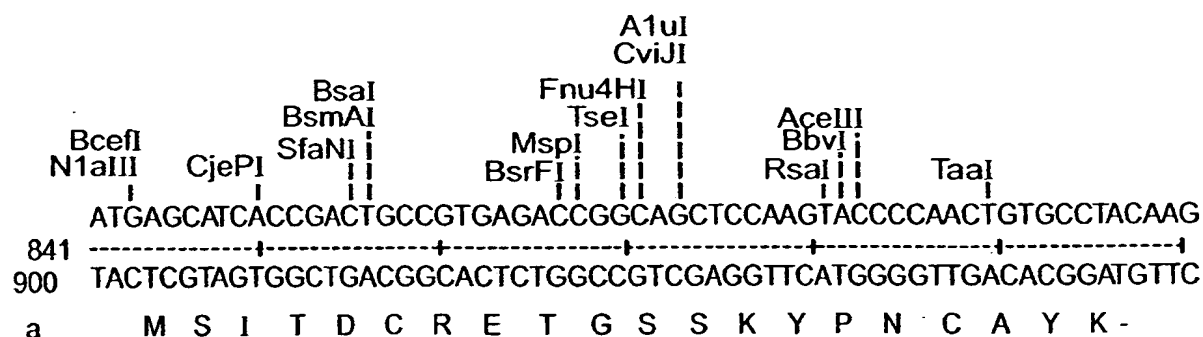
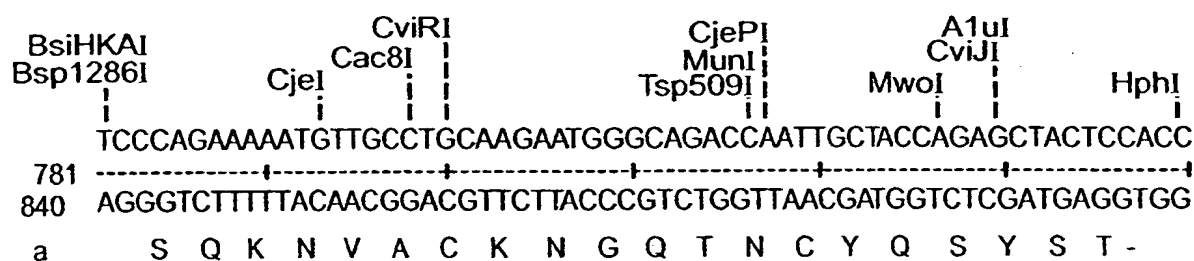
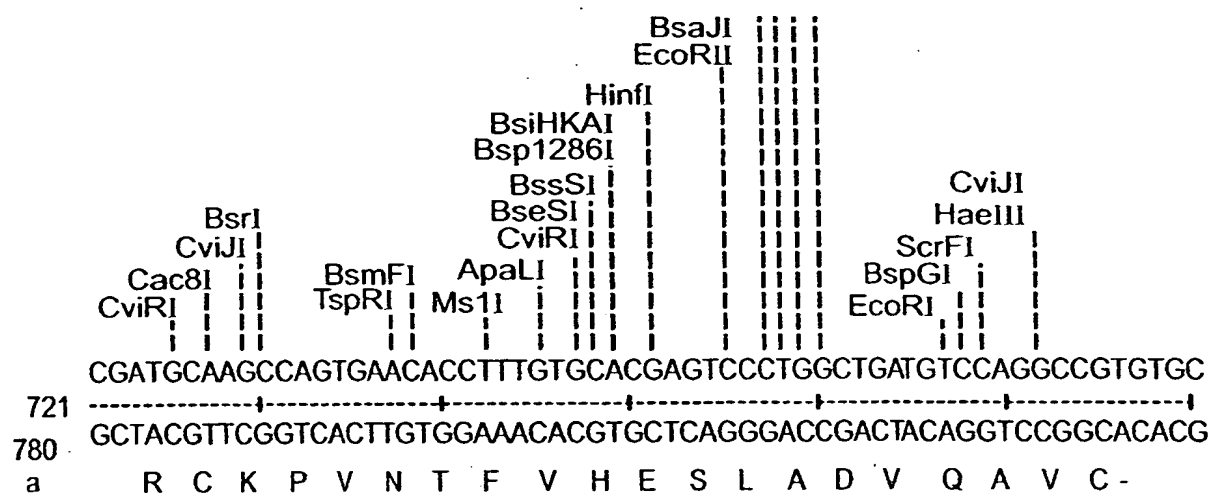
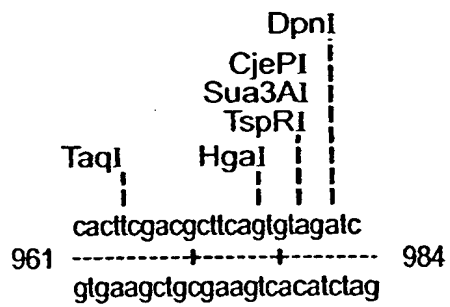


Fig. 4f

a T T Q A N K H I I V A C E G N P Y V P V -



a H F D A S V * I -

Fig. 4g

KEY:

CBD = Cellulose binding domain

CCP = Cellulose cross - linking protein

PSU = Polysaccharide structural unit

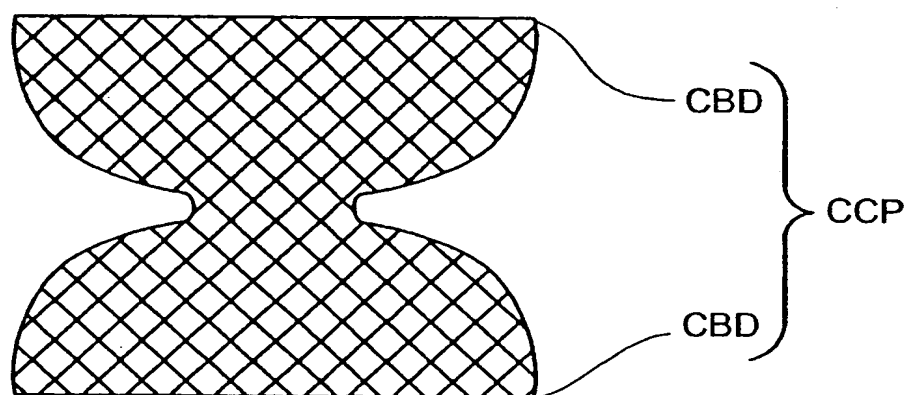


Fig. 5a

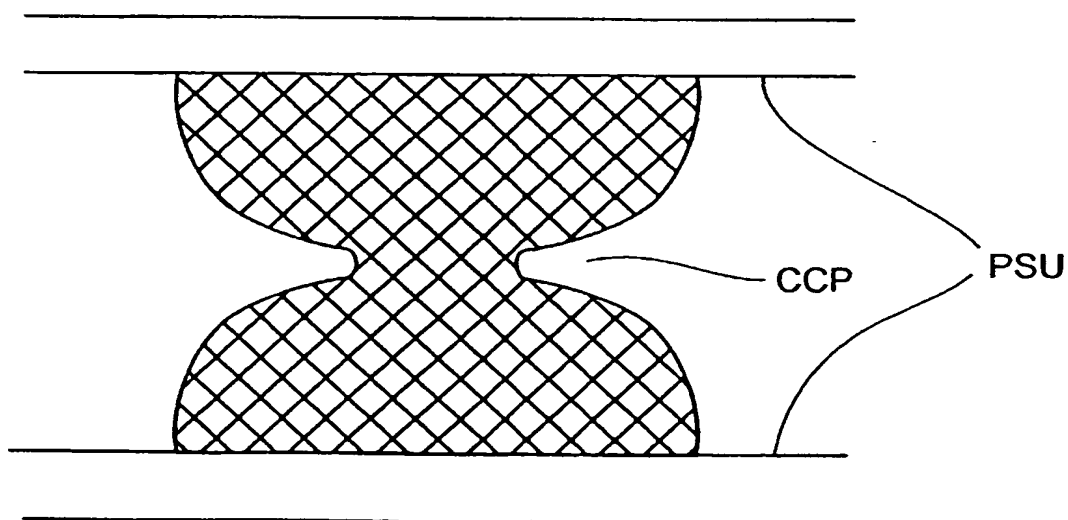


Fig. 5b

KEY:
CBD = Cellulose binding domain
LU = Linker unit
CU = CBD coupler unit

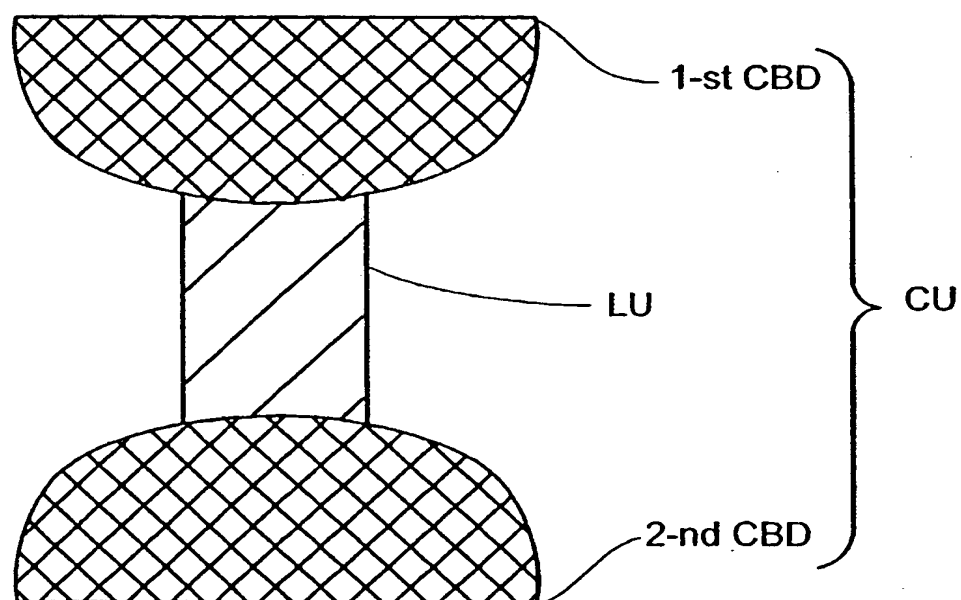


Fig. 6

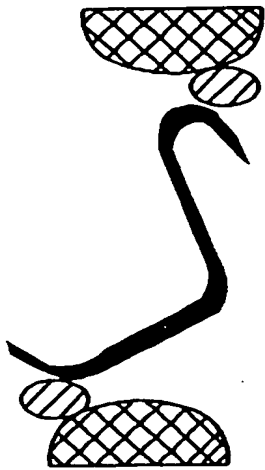


Fig. 7a

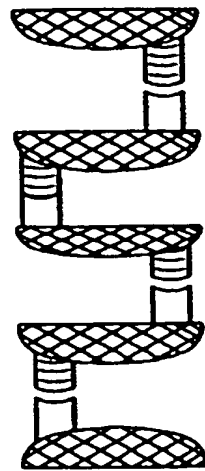


Fig. 7b

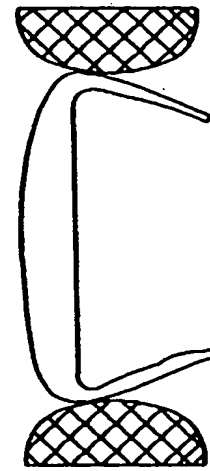


Fig. 7c

KEY:



= CBD



= STARCH BINDING DOMAIN



= STARCH



= JUN



= FOS



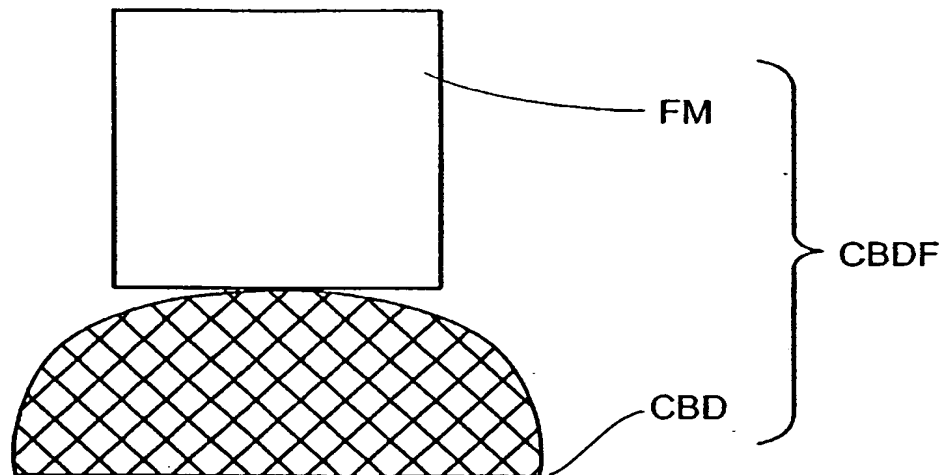
= LARGE PROTEIN MOIETY

KEY:

CBDF = CBD functional moiety

CBD = Cellulose binding domain

CU = Functional moiety

**Fig. 8**

KEY:

PSU = Polysaccharide unit

CBD = Cellulose binding domain

LU = Linker unit

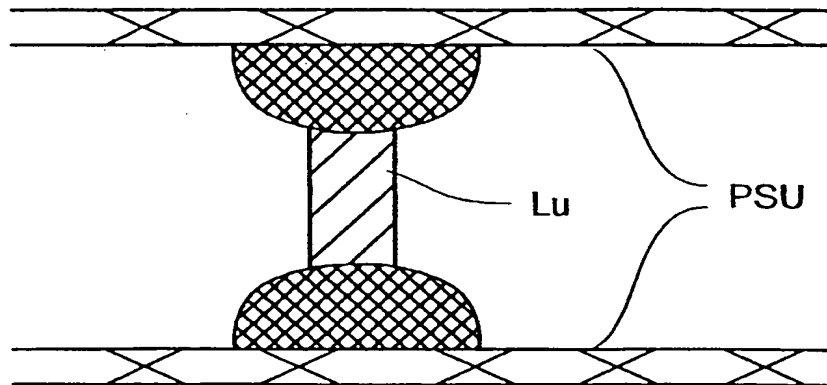


Fig. 9a

KEY:

PSU = Polysaccharide unit

CBD = Cellulose binding domain

LU = Linker unit

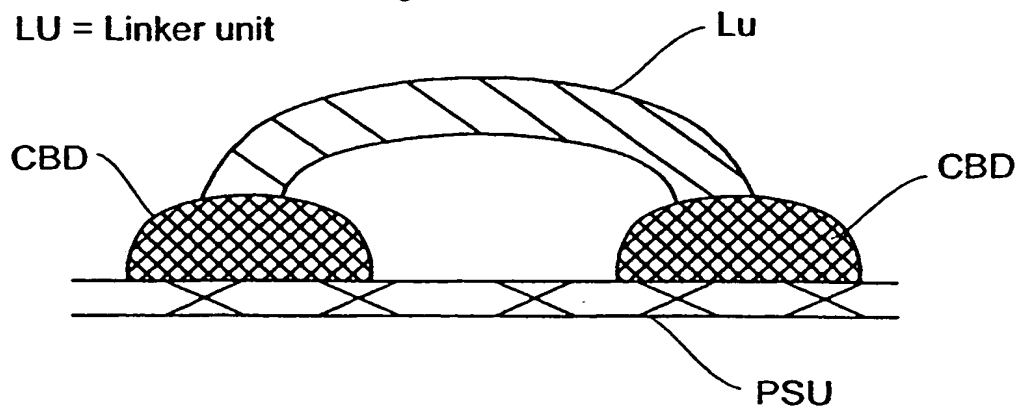


Fig. 9b

KEY:

PSU = Polysaccharide unit

CBD = Cellulose binding domain

LU = Linker unit

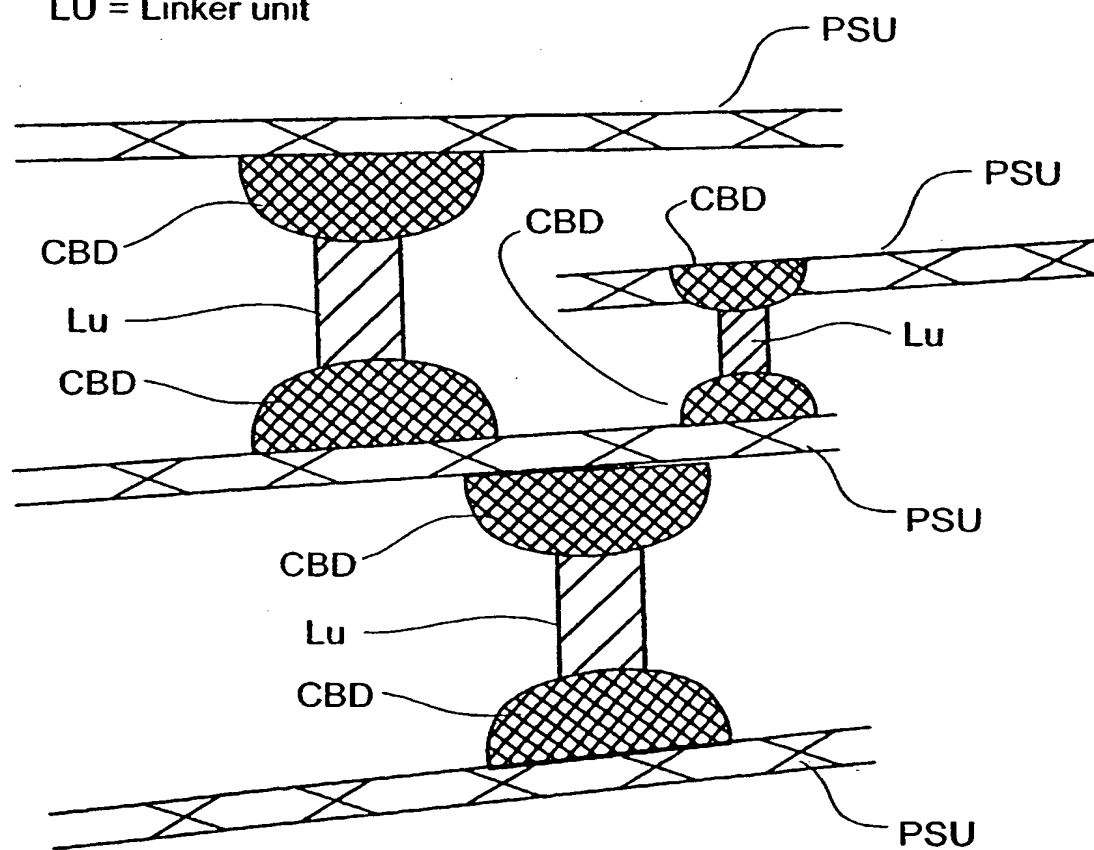


Fig. 9c

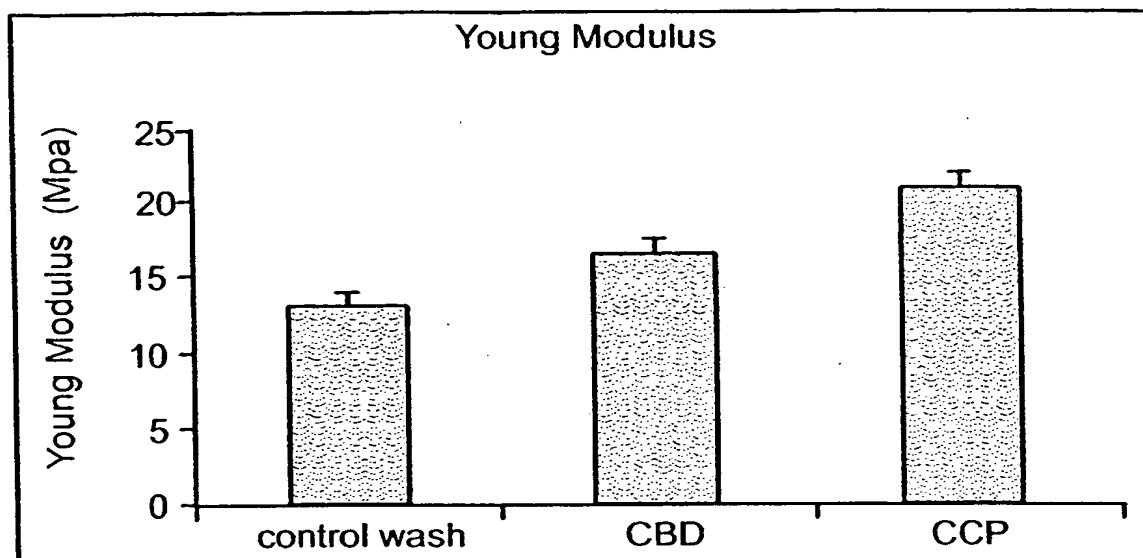


Fig. 10a Young Modulus of CBD and CCP treated papers

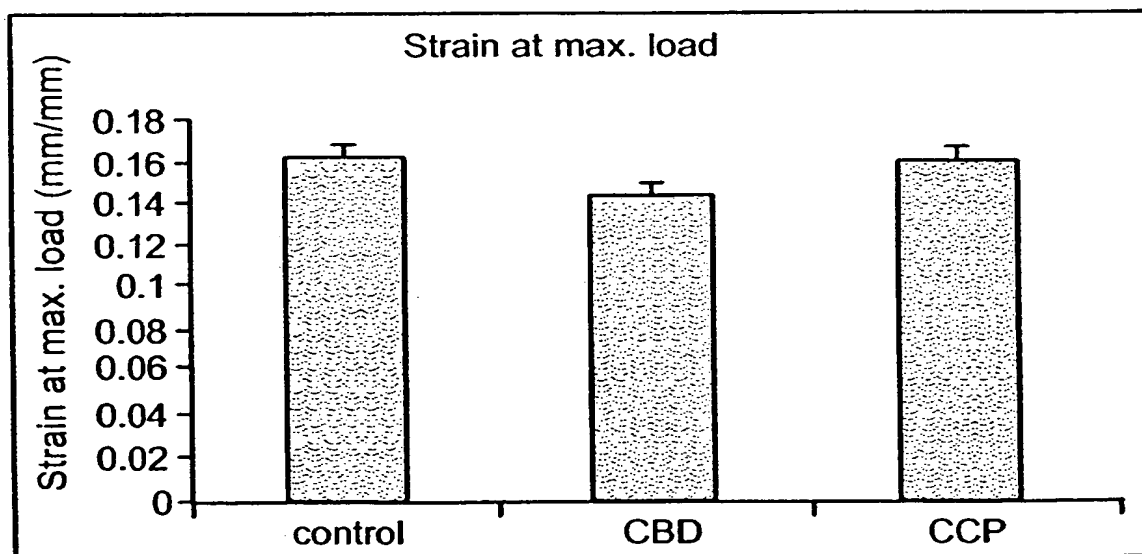


Fig. 10b Strain at maximum load of CBD and CCP treated papers

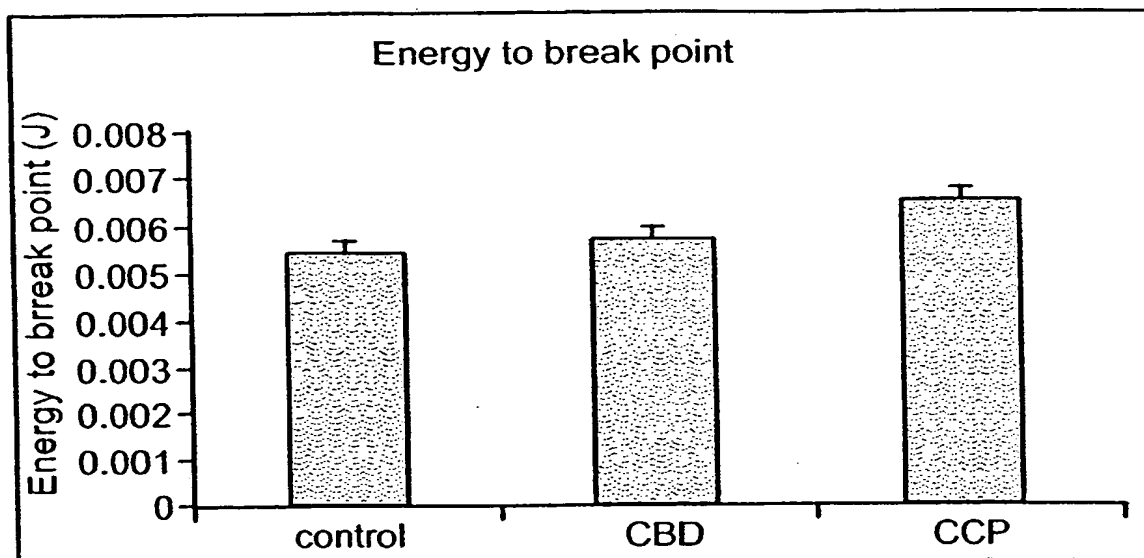


Fig. 10c Energy to break points of CBD and CCP treated papers

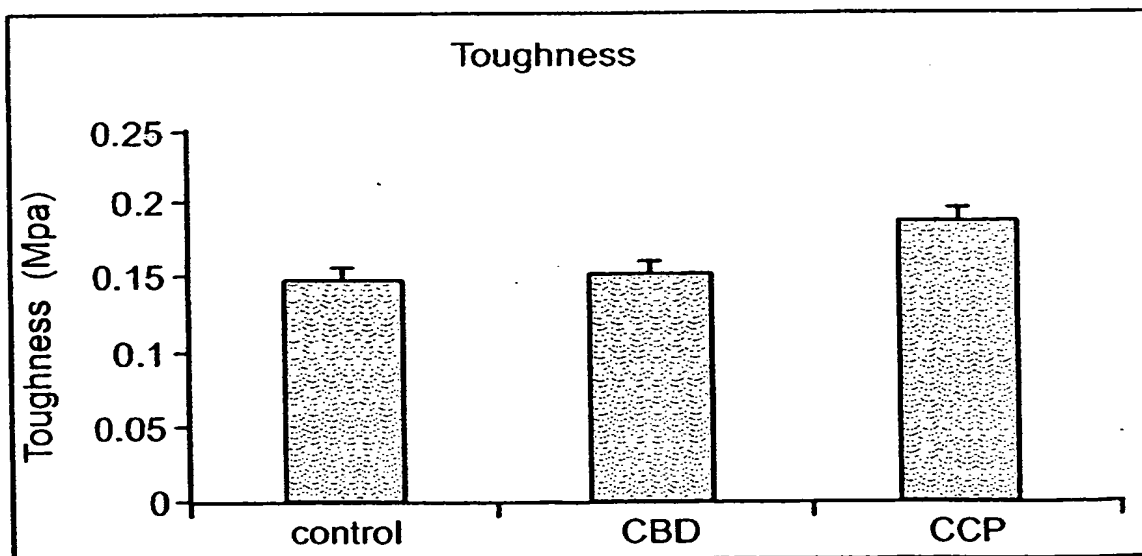


Fig. 10d Toughness of CBD and CCP treated papers

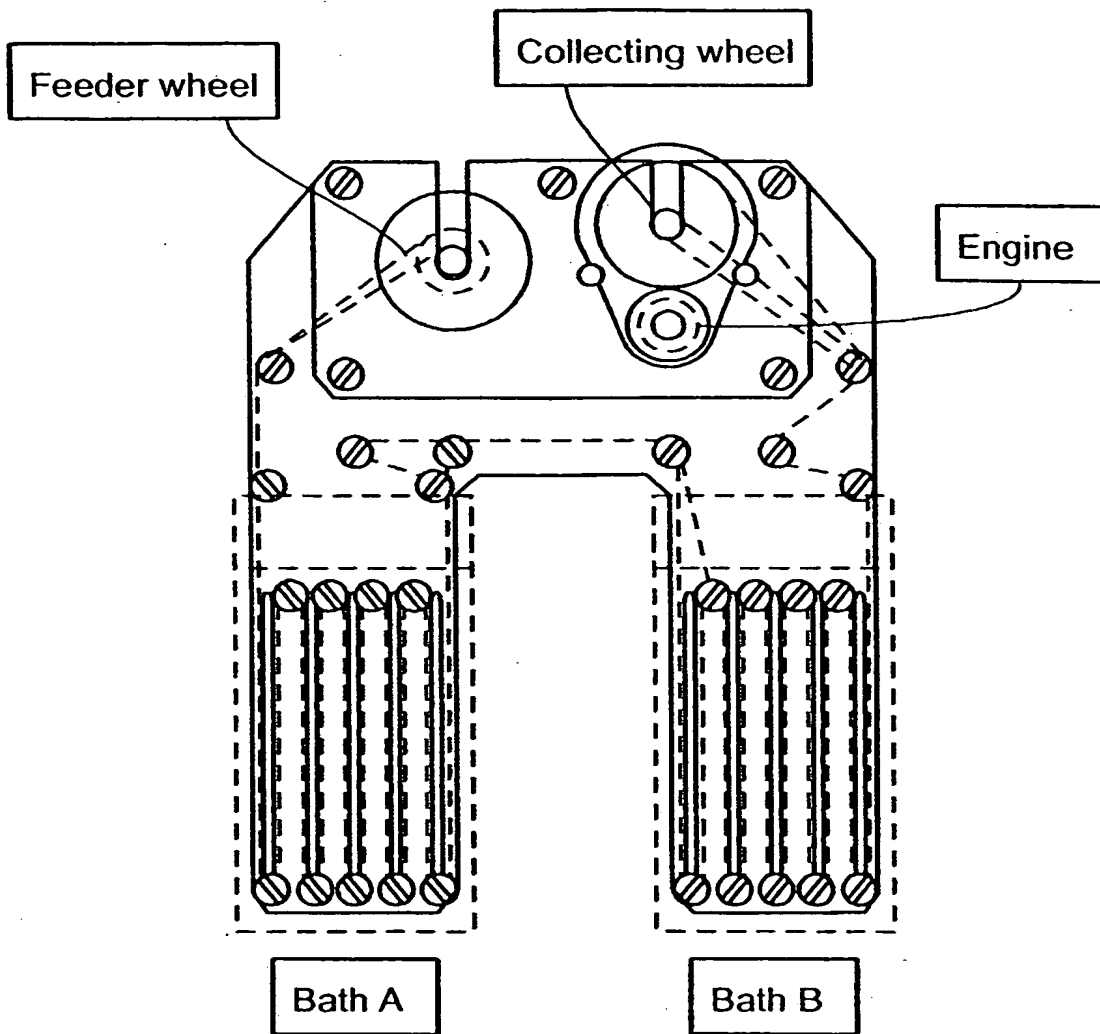


Fig. 11 Yarn treatments

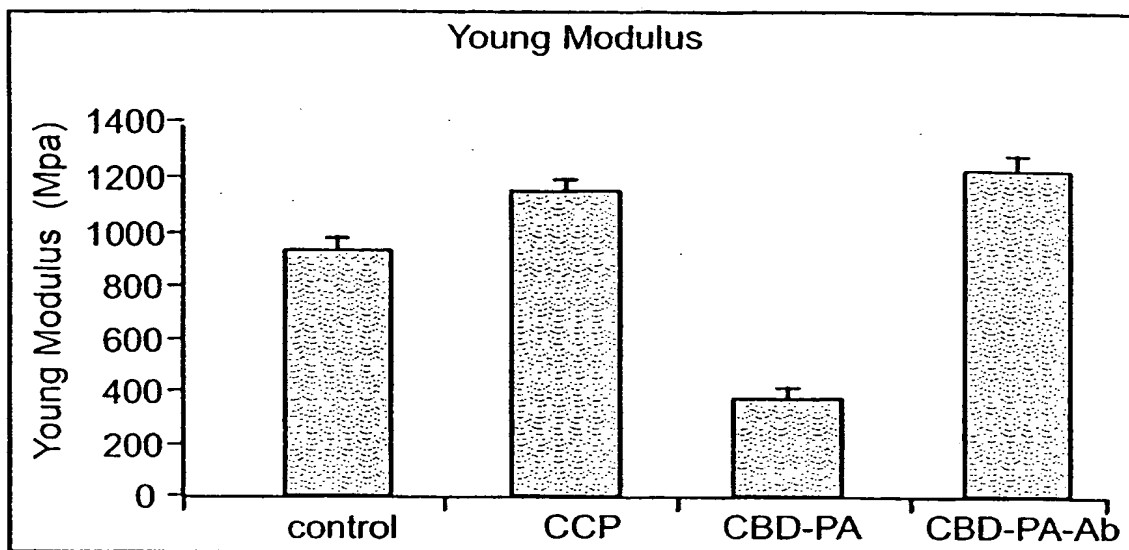


Fig. 12a Young modulus of CCP, CBD-PA and CBD-PA-Ab treated cotton yarn

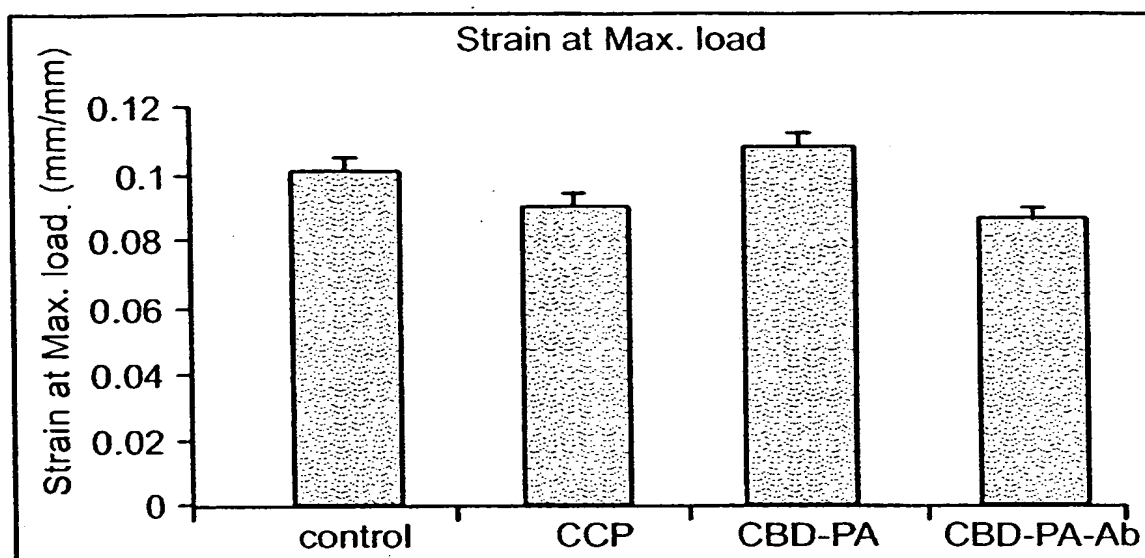


Fig. 12b Strain at maximum load of CCP, CBD-PA and CBD-PA-Ab treated cotton yarn

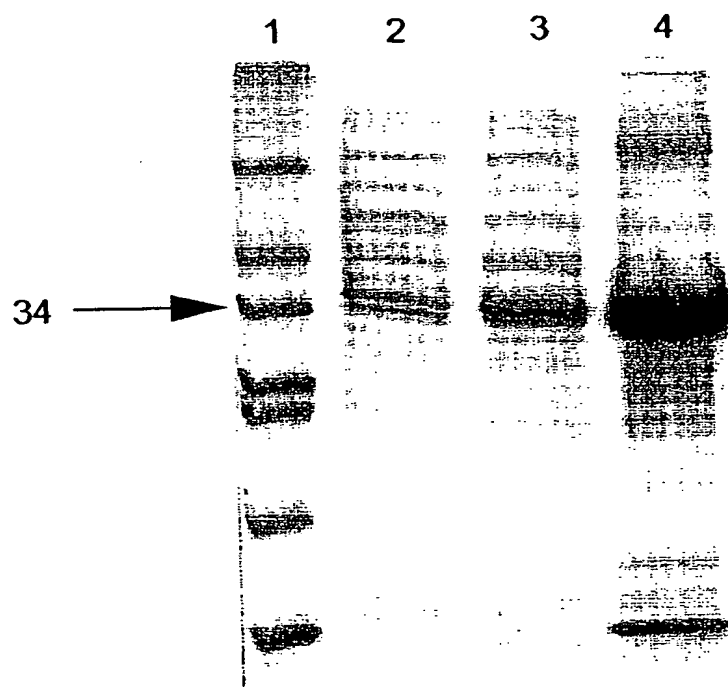


Fig. 13

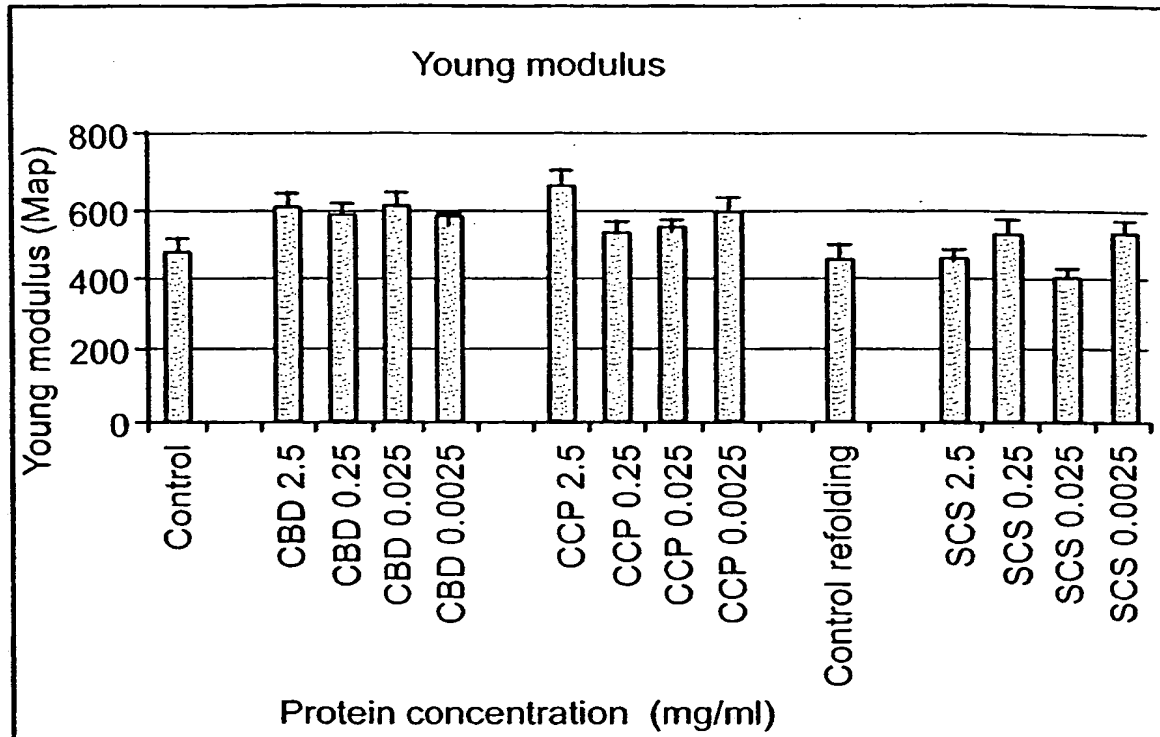


Fig. 14 Young modulus of CBD CCP and SCS treated Whatman papers.

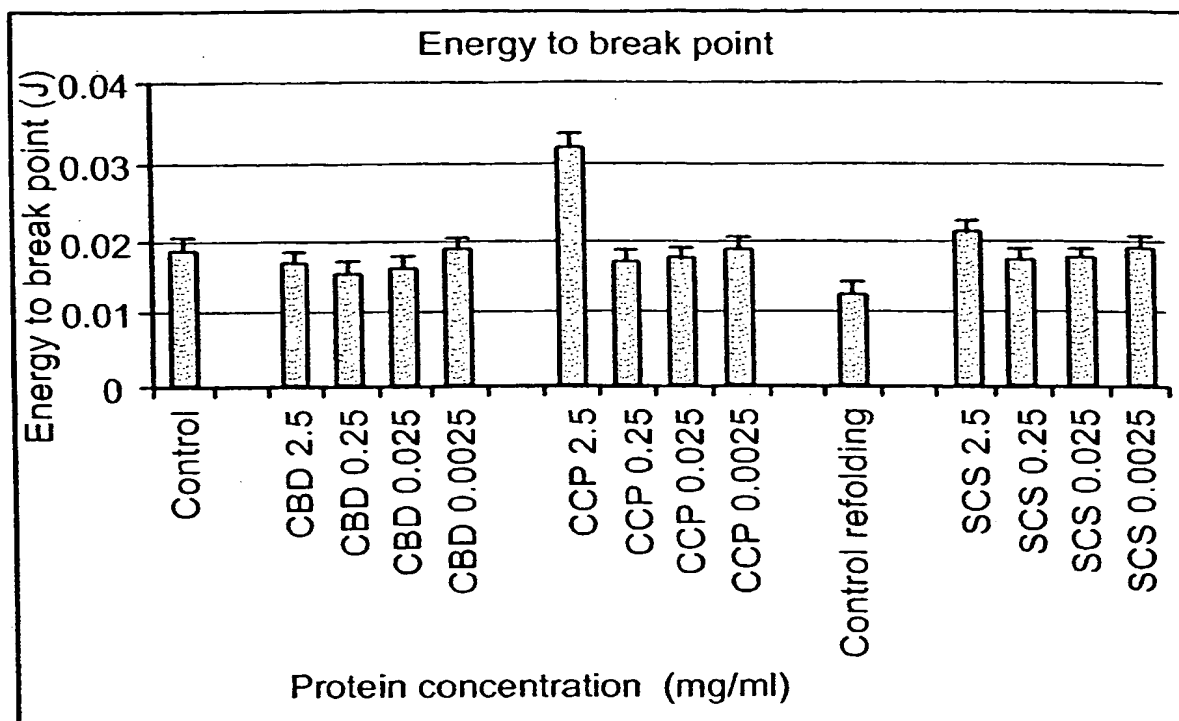


Fig. 15 Energy to break points of CBD CCP and SCS treated Whatman papers.

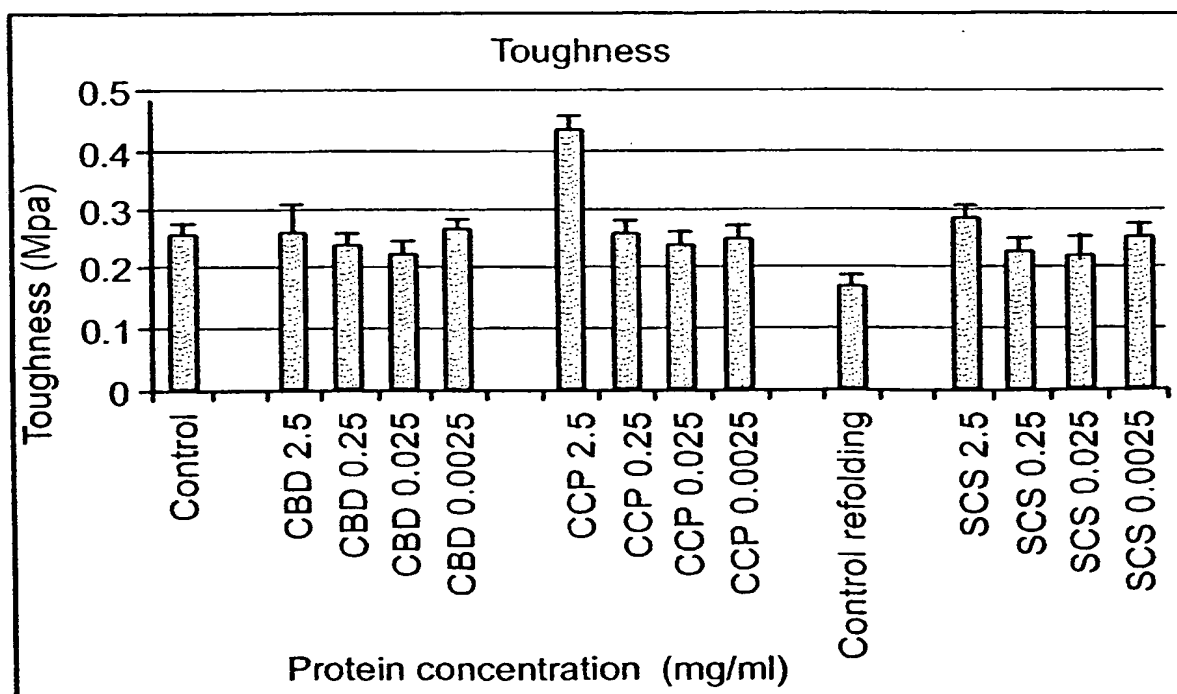


Fig. 16 Toughness of CBD CCP and SCS treated Whatman papers.

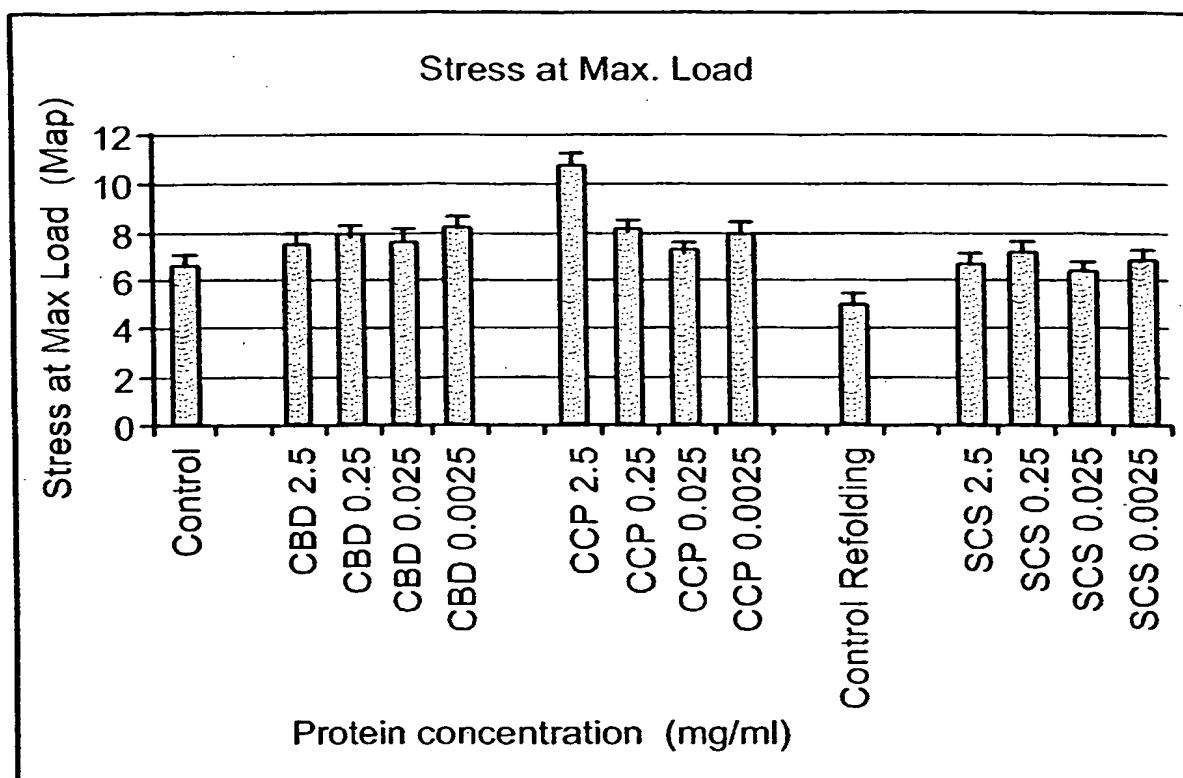


Fig. 17 Stress at maximum load of CBD CCP and SCS treated papers. All treatments increased the Stress at maximum load of Whatman papers, which demonstrates an increase to the strength of the paper.

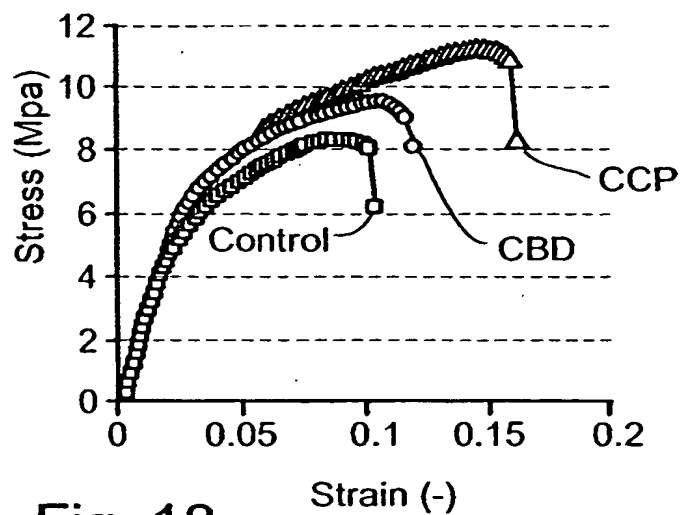


Fig. 18

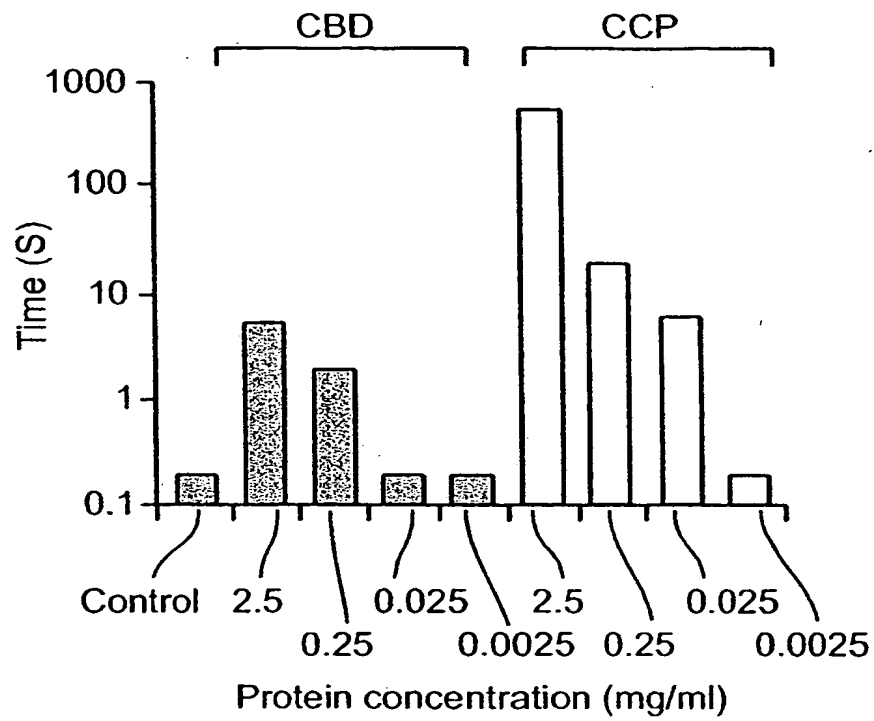


Fig. 19

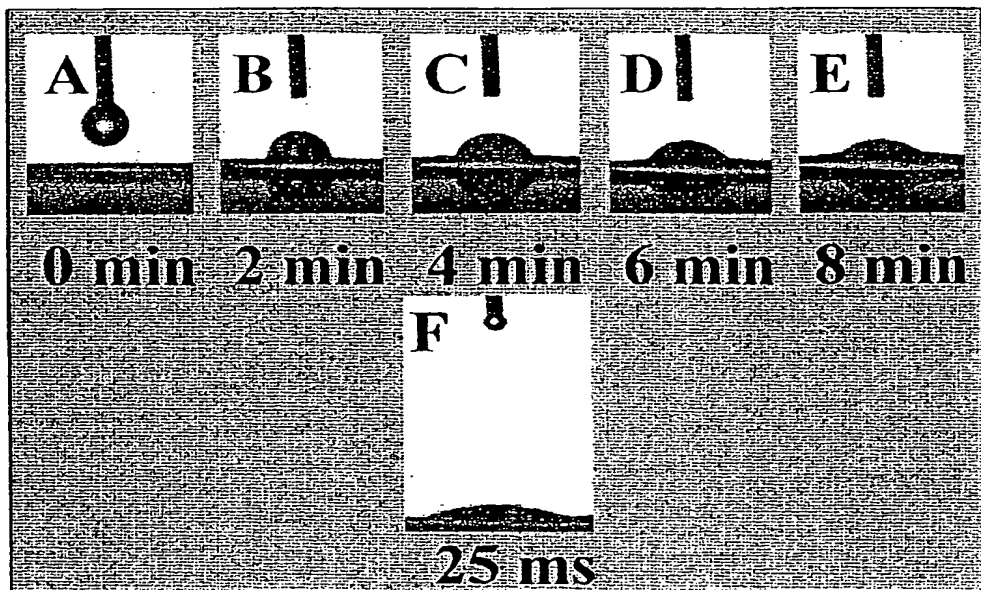


Fig. 20